ARMY ORDNANCE

THE JOURNAL OF THE ARMY ORDNANCE ASSOCIATION

Founded 1920

Pledged to Industrial Preparedness as Our Strongest Guaranty of Peace

Volume XXI **JANUARY-FEBRUARY, 1941** **No. 124**

CONTENTS

Eyes of the Fleet		Frontispiece
Production for Defense	By William S. Knudsen	333
Weapons and the Army	By Robert P. Patterson	336
Rearmament Progress		337
Our Armament Goes Forward	By Maj. Gen. C. M. Wesson	341
Ordnance Procurement	By Maj. Gen. James H. Burns	343
Antitank and Antiaircraft Guns	By Brig. Gen. R. H. Somers	345
Building Our Navy	By Lewis Compton	347
The Fleet	(Pictorial)	349
The Bases of National Defense	By Hoffman Nickerson	357
Tanks	By Lieut. Col. J. K. Christmas	363
Ordnance Maintenance Company Vehicles	*Facing*	364
Ordnance Engineering	By Brig. Gen. G. M. Barnes	365
Ordnance Production	By Brig. Gen. Burton O. Lewis	366
Artillery Ammunition	By Col. H. H. Zornig	367
Ordnance Facilities	By Brig. Gen. L. H. Campbell, Jr.	369
The Arsenal Commanders		370
Month by Month		372
Shadow Factories	An Editorial	374
Association Affairs		375
Ordnance in Review	By Lieut. Col. Calvin Goddard	381
Ordnance Reserve		382
Professional Digest		384
Book Reviews		390
Index of Advertisers		442

Published by the Army Ordnance Association, Suite 806, Mills Building, Washington, D. C. Managing Editor: Lieut. Col. L. A. Codd, Ord. Res.; Associate Editor: R. E. Lewis, Jr. Authors are responsible for statements and opinions expressed in their articles. Copyright, 1940, by the Army Ordnance Association, Washington, D. C. Permission to republish is reserved.

Issued bimonthly. Single copy 75¢ (by mail). Subscription rate: continental U.S., $4.50 annually; foreign, $5.50, in advance. Entered as second-class matter, August 14, 1920, at the Post Office at Washington, D.C., under the Act of March 3, 1879. Additional second-class entry at the Post Office at Richmond, Va. Three weeks' notice before next issue required for change of address.

THE ARMY ORDNANCE ASSOCIATION

The Aims, Purposes, and National Officers of the Society

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guaranty of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency, time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

The Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

The Association is devoted solely to the national defense; it has no commercial interests, no political alliances, and no religious affiliations. It is not operated for profit: its income is expended in furthering its aims. Its officers and directors serve without remuneration. Membership, to which American male citizens are eligible, is four dollars a year. (Application on request.)

ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guaranties of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect coöperation with American scientists, inventors, engineers and manufacturers in civil life and the Regular and Reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

Officers

President: BRIG. GEN. BENEDICT CROWELL, Cleveland, Ohio
1st Vice-President: COL. WILLIAM W. COLEMAN, Milwaukee, Wis.
2nd Vice-President: COL. FREDERICK H. PAYNE, Greenfield, Mass.
Treasurer: BRIG. GEN. CHAS. ELLIOT WARREN, New York, N. Y.
Counsel: BRIG. GEN. JOHN ROSS DELAFIELD, New York, N. Y.

Directors

MAJ. GEN. WILLIAM CROZIER, Washington, D. C.

MAJ. GEN. C. C. WILLIAMS, South Hamilton, Mass.
BRIG. GEN. SAMUEL MCROBERTS, New York, N. Y.
COL. ROBERT P. LAMONT, New York, N. Y.
COL. FRANK A. SCOTT, Cleveland, Ohio
COL. JAMES L. WALSH, New York, N. Y.
MR. EDMUND A. RUSSELL, Chicago, Ill.
COL. BRUCE CORNWALL, San Francisco, Calif.
MR. W. C. DICKERMAN, New York, N. Y.
COL. HARRY SCULLIN, St. Louis, Mo.
MR. L. W. SCOTT ALTER, Cincinnati, Ohio
COL. THEODORE SWANN, Birmingham, Ala.
LIEUT. COL. LEROY HODGES, Richmond, Va.
COL. HERBERT A. GIDNEY, Pittsburgh, Pa.
MR. EARL B. GILMORE, Los Angeles, Calif.
COL. CHARLES H. TENNEY, Springfield, Mass.
MR. GEORGE W. ELLIOTT, Philadelphia, Pa.

Executive Vice-President and Secretary: LIEUT. COL. L. A. CODD, Ord. Res.
Assistant Secretary: FLORENCE G. FERRITER
Executive Offices: Mills Building, Pennsylvania Avenue at 17th Street, Washington, D. C.

LOCAL POSTS OF THE ASSOCIATION

The Officers and Headquarters of the Sixteen Chapters

BIRMINGHAM, ESTABLISHED DECEMBER 3, 1930

President: Theodore Swann. Vice-President: Lindley C. Morton. Directors: Thomas Martin, Oscar Wells, Hugh Morrow, W. D. Moore, Erskine Ramsay, L. E. Geohegan, Wade H. Oldham, R. C. Stobert. Treasurer: Richard J. Stockham. Secretary: W. F. Vander Hyden, 1908 Comer Building, Birmingham, Ala.

BOSTON, ESTABLISHED JUNE 30, 1925

President: C. S. Robinson. Vice-President: C. W. H. Cowdrey. Directors: T. L. Ames, R. J. Thanisch, M. T. Carney, A. E. Anderson, C. E. Fuller, W. Van Pattensteiger, R. E. Goho. Treasurer: Archibald McMillan. Secretary: J. S. Crawford, 140 Federal St., Boston, Mass.

CHICAGO, ESTABLISHED MAY 3, 1924

President: Edmund A. Russell. Vice-President: F. W. Parker, Jr. Directors: W. R. Wright, W. H. Damon, F. A. Preston, G. G. Thorp, W. B. Hobbs, C. A. Tibbals, Jr., Sterling Morton. Treasurer: W. H. Damon. Secretary: Donald Armstrong, 309 W. Jackson Boulevard, Chicago, Ill.

CINCINNATI, ESTABLISHED DECEMBER 10, 1925

President: J. B. Doan. Vice-President: A. H. Tuechter. Directors: E. A. Muller, R. K. LeBlond, B. B. Quillen, A. H. Pugh, F. V. Geier, E. D. Smith, A. F. Hubbard, H. C. Knowles. Treasurer: J. D. Wyatt. Secretary: F. A. McMahon, 831 The Enquirer Building, Cincinnati, Ohio.

CLEVELAND, ESTABLISHED OCTOBER 25, 1940

President: Clifford F. Hood. Vice-Presidents: John C. McHannan and Rufus J. Wysor. Directors: Robert F. Black, Hosea T. Bradner, Ward M. Canaday, Fred Chapin, Frederick C. Crawford, Ben F. Hopkins, Adrian D. Joyce, Frank Purnell, Edward J. Thomas. Secretary-Treasurer: Harold M. Reedall, 1450 Terminal Tower, Cleveland, Ohio.

LEHIGH-BETHLEHEM, ESTABLISHED NOVEMBER 15, 1939

President: Richard M. Shepherd. 1st Vice-President: R. B. Gerhardt. 2nd Vice-President: Robert I. Felch. Treasurer: Leonard J. McKinley. Secretary: Robert Caemmerer, Lehigh University, Bethlehem, Pa.

LOS ANGELES, ESTABLISHED MAY 27, 1936

President: Earl B. Gilmore. Vice-President: Donald Douglas. Directors: W. H. Adams, Ralph O. Cragin, H. S. Hitchcock, M. A. Koffman, M. M. Mitchell, F. B. Cole. Treasurer: Samuel K. Rindge. Secretary: Ralph C. Scott, 2146 W. Adams Blvd., Los Angeles, Calif.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ESTABLISHED JANUARY 20, 1922

President: David McNally. Vice-President: Teddy Walkowicz. Executive Committee: Raymond Koch, William Cadogan, Daniel Hulett, Francis Herlihy, Edward Hayes, Robert Boyer. Secretary-Treasurer: Herbert R. Moody, Department of Military Science, M.I.T., Cambridge, Mass.

MILWAUKEE, ESTABLISHED SEPTEMBER 26, 1928

President: W. W. Coleman. Vice-President: Eric H. Lichtenberg. Directors: A. G. Peter, Roger Sherman Hoar, R. E. Friend, D. P. Davies, J. E. DeLong, Max W. Babb, H. V. Kohler, Frank R. Bacon, Harold Falk. Secretary-Treasurer: C. W. Laumann, Bucyrus-Erie Company, So. Milwaukee, Wis.

NEW YORK, ESTABLISHED JUNE 15, 1921

President: Samuel McRoberts. 1st Vice-President: Crosby Field. 2nd Vice-President: James E. McNary. 3rd Vice-President: R. E. Gillmor. 4th Vice-President: Thomas E. Murray. Executive Committee: The Officers and Thomas F. Brown, C. Stewart Comeaux, W. C. Dickerman, Charles J. Hardy, H. M. Tillinghast, J. R. White. Treasurer: W. John Hoffman. Secretary: J. K. Clement, 80 Broadway, New York, N. Y.

PHILADELPHIA, ESTABLISHED DECEMBER 9, 1926

President: Philip H. Gadsden. Vice-President: George W. Elliott. Directors: E. T. Longstreth, J. L. Poultney, C. L. Jordan, John Q. MacDonald. Secretary: D. N. Hauseman (acting), 1417 Mitten Building, Philadelphia, Pa.

PITTSBURGH, ESTABLISHED FEBRUARY 24, 1927

President: Herbert A. Gidney. Vice-President: C. W. Heppenstall. Directors: Frank B. Bell, G. M. Sixsmith, S. L. Goodale, F. A. Merrick, W. F. Detwiler, J. D. Berg. Treasurer: G. Elkins Knable. Secretary: James L. Guion, 1032 New Federal Building, Pittsburgh, Pa.

ROCHESTER, ESTABLISHED APRIL 29, 1938

President: Frank J. Smith. Vice-President: Edward H. Halbleib. Directors: F. F. Hickey, James E. Gleason, A. F. Sulzer, J. K. Baylis, Carl S. Hallauer, David W. Sowers and William Kelly. Treasurer: Paul Folger. Secretary: Roy L. Bowlin, 1118 Mercantile Building, Rochester, N. Y.

ST. LOUIS, ESTABLISHED JANUARY 18, 1927

President: Edwin B. Meissner. Vice-President: W. C. Bliss. Directors: Willard R. Cox, E. W. Davis, H. B. Deal, W. H. Bixby, J. M. Kurn, Harry Scullin. Secretary-Treasurer: R. J. Hogan (acting), 1114 Market Street, St. Louis, Mo.

SAN FRANCISCO, ESTABLISHED OCTOBER 17, 1923

President: Roland L. Oliver. Vice-President: Leonard F. Fuller. Directors: D. C. Jackling, J. J. Thomas, Samuel Kahn, A. Leslie Oliver. Secretary-Treasurer: C. C. Harshman, 118 Federal Office Building, San Francisco, Calif.

WASHINGTON, ESTABLISHED NOVEMBER 18, 1925

President: F. H. Miles, Jr. Vice-President: Henry P. Erwin. Directors: Swagar Sherley, Fred E. Wright, LeRoy Hodges, Fred. H. Wagner, Hardee Chambliss, S. E. Reimel, Paul Weeks, Philip Schwartz. Treasurer: C. E. McRae. Secretary: R. O. Eliason, 806 Mills Building, Washington, D. C.

Official Photograph U. S. Navy

Eyes of the Fleet

ARMY ORDNANCE

Volume XXI JANUARY-FEBRUARY, 1941 No. 124

Production for Defense

A Report on Rearmament Progress

By William S. Knudsen*

THIS is not in any way to be considered a speech or an address but merely a report, after a fashion, on the work my division has done in the four months of its existence. I need not dwell on the personnel of the Production Division of the Commission. The same men—Messrs. Biggers, Vance, Johnson, Mead, Land, Moffett, Harrison, and Nichols—are still working unselfishly at their jobs, and whatever we have accomplished is due in great measure to their efforts. I told the Ordnance district chiefs in Washington last month about the appropriations and the corresponding schedules for material as furnished by the Army and the Navy, and it is sufficient to say that we have appropriations and schedules which will keep us busy until the end of November. The amount of contracts cleared up to and including September 28th was $3,153,000,000 for the Army and $5,100,000,000 for the Navy, or a total of $8,253,000,000 with approximately $4,000,000,000 to go. The balance of the $16,000,000,000 expenditure provided by Congress includes pay of Army and Navy, food, travel, and other items we don't clear.

To place the contract situation before you in slightly more detail, I have prepared a tabulation (see table on p. 334).

This is a large amount of work to throw into the productive labor picture of the United States and will have its effect on general business conditions after it gets under way. We decided at the start to superimpose the program on the regular business of the country in order to absorb as much idle plant and men as was possible at the beginning and then adjust later when the defense load was spread. One of our many constructive critics took me to task last week in the papers for doing this, saying that it was all well and good to superimpose the program on the regular business but that he felt it should be the other way around in order that the defense program could really get a clear track. This of course is all right after the program is ready—what he did not realize was that shop drawings, tooling, and materials have to be provided before we can adjust the load. In this respect we are reminded of Mr. Kettering's famous remark that "two hens sitting on the eggs do not produce the chicks in half the time"!

However, rightly or wrongly, three months on the first appropriation of thirty-six per cent of the amount, with the other sixty-four per cent coming on September 10th, will not produce much finished stock as yet, but we have hopes that in getting it out in the field and having manufacturing brains work on it, some time late next spring or early summer we will have something to show.

Another problem which popped off right at the start was the amortization scheme and the suspension of the Vinson-Trammell Act. We had a rather tough time trying to convince people that we were not giving factories away for nothing. The difficulty was that many people thought that five years' amortization meant that the plant was free and clear after five years, while the tax bill only provided for the tax on it, or about twenty per cent of the total. I even suspect some of the best minds in Washington of having been a little foggy on this point.

There is no question but that during the World War many plants were not used because the war did not last long enough to get all the facilities into use, but I cannot remember any company in particular which reaped a good deal of profit out of unused plant facilities that remained idle for years and were full of equipment which had little or no market value commercially. So in order to cover this point in the beginning, a plant-facilities contract was developed whereby a separate arrangement was made for the plant and another for the article. This was done in order not to unduly inflate the price level.

The facilities were grouped into three classes: (1) Strictly complete munitions plants which would have no commercial value after the emergency, built by the Government, operated under a management-fee contract, and returnable to the Government by the management after completion of orders—the title to the property resting with the Government at all times; (2) A plant built and operated by a private manufacturer toward the cost of which the Government would subscribe twenty per cent annually for five years and take progressive title to the property as the payments are made, with the provision that the manufacturer would have the right to purchase the property at that period or before, if the emergency should not last five years, by paying the original cost of the plant, less specific depreciation rates outlined in the contract, or to negotiate for a price below this, with the contracting agency having the refusal of the offer and the right to keep the plant; (3) Where a partial expansion of the plant should take place the method followed as in class (2), except where the negotiations failed at the end of the emergency, the Government could not take the addition to the plant but would have to demolish the financed portion and restore the property to its original state.

In the case of subcontractors' tax amortization certificates, the prime contractor would act for the Government, subject to check by our Commission, and the proper certificate would be issued with the approval of the procurement agency of the Army and/or the Navy, as the case might be. In the case of a large subcontractor who did work for many general contractors, as in the aircraft-accessory industry, a plant contract

*Chief, Production Division, National Defense Advisory Commission. This is an address delivered at the Annual Dinner, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

without the component contract can be negotiated direct with the Government. The idea of all this was to make the Government contract bankable and get private finance to take a hand in the program, and I am happy to say that the response has been quite encouraging. Both banks and business generally have in the past looked rather askance on Government contracts due to their small size and string of regulations, but I do think and hope that we have succeeded in eliminating many of the obstacles that existed before. I cannot stress too strongly the absolute necessity for getting the entire American business structure into the defense program. This is your program—your brains are going to produce it and your money is going to help to pay for it.

There is a school of thought in Washington which feels that the Government should go into business on a large scale. The Government *is* in business on a large scale right now—on a scale as big as it can handle—on a larger scale than any other country except perhaps Russia, and we don't want any part of the Russian system over here. The success of our program depends upon the brains and patriotism of the American banker, businessman, engineer, executive, and workingman. This is where a pull-together effort is not only desirable but is an indispensable necessity for the security of our shores.

MILITARY ARMAMENT STATISTICS

	Number of Manufacturers	*Number of Contracts*	*Amount in Dollars*
Air Corps	53	88	$1,331,806,168.34
Chemical Warfare Service	3	3	2,667,789.39
Corps of Engineers	8	11	34,531,210.00
Ordnance (ammunition)	35	42	277,203,454.24
Ordnance (equipment)	73	138	902,563,834.16
Quartermaster Corps	341	615	261,854,997.44
Signal Corps	18	23	41,718,812.19
Total	531	920	$2,852,346,265.76

(Total, including arsenals, $3,153,436,283.11. There is some slight duplication in the number of manufacturers for Ordnance, both ammunition and equipment, and the Quartermaster Corps. Compiled as of September 28, 1940.)

ANOTHER absolutely indispensable factor is speed. We need, particularly during the tooling period, all the effort you can give us. Builder, machine manufacturer, and engineer—give us whatever you can give of your time, without impairing your health, that will make a sizable contribution to the pot. You are the people whom we can call upon to give us time without running afoul of the Wages and Hour Law, and, believe me, we need your strength and skill as we never needed them before. After we get the tools finished, the machines will turn out the stuff. The American worker fundamentally loves to see the shop run; if we can get him tooled up right he will produce the stuff. We don't need any slogan except "here is where we live," and we are going to keep right on living here in our own way!

I get many letters from people who seem really moved over the possibility of success in the program. Some of them are pathetic and some are funny, but they all stress the one thing —"this is our home—see to it that it is preserved."

BUT to get back to the physical side of the program: Taking it by items, I shall start with airplanes and engines. I have visited every airplane plant in the United States and all but two of the engine plants. The picture is something like this: We are scheduled to turn out 1,133 planes in October. I think we will get around 900 to 950. The reason for this is the extremely rapid expansion which is taking place concurrent with the production program. We hope to reach 1,250 planes by January 1st and 1,500 planes by July 1st; after that we should do better up to the spring of 1942, when we hope to reach 3,000. A great change is coming over the airplane industry. The plane builders up to the spring of this year had small orders with constant changes and each plane was hand-built from nose to tail. However, with the large British and American orders now on hand, the old American ingenuity is getting into play. Planes are split up into minor assemblies. Subcontractors are engaged to do certain branches of the work; and right here lies the answer to airplane production—split assemblies for few or preferably one design and purchase the skill for the small parts where specialty manufacturers can supply it. One of these days we will actually have a set of tools for an airplane, and then we will get production right!

On engines, about the same thing applies except here there is more machine work, and good progress is being made in producing quantities. With the necessary accuracy and close limits at around a pound per horsepower, the error factor must be reduced to practically nothing in order for the motor to stand the stresses. I have seen some beautiful work on this last trip, and quantity production on engines is practically dependent on the amount of machine tools we can give them. The "know how" is there. Engine production in September was about 2,400, of which 1,500 were combat engines and the balance for trainers. We are fortunate here in having manufacturers who have been in the business for years and who have developed skill in engine building; and we are equally fortunate in having large-scale manufacturers like Ford, Packard, Studebaker, and General Motors pitch in to help the program.

The next item is tanks, and there is no production as yet except on the light tank weighing about thirteen tons. Here we are getting about one hundred per month. On the heavier units, much redesigning had to be done in order to meet combat experience in France, but we have three responsible manufacturers lined up for these and should have production next May. The more I see of tanks the more I am convinced that we will have to employ welding. I am told that when a bullet hits a rivet the rivet and not the bullet is liable to kill a man inside the tank. I have had some very interesting experiments lately with welding which look quite promising.

Regarding field guns, we all can remember that in the World War the limiting factor of our military effectiveness was artillery. The present war in Europe has brought home the importance of antitank and antiaircraft guns. The arsenals are all working twenty-four hours a day and private manufacturers will come in as fast as we can get the tools. Machine guns are all placed and so are the 37-mm. guns. Small arms and ammunition are not going to be too late.

We have a sizable stock of rifles on hand and are all set up to produce more.

ON powder and explosives, the status is about like this: we have located two powder plants, two high-explosives plants, five loading plants, two ammonia plants—a total of eleven—and we have five more projected. I need not tell you gentlemen that the powder program was awfully late in getting started, and it is of greatest importance that this time we keep the plants after we get them going. After the last war, as far as I have been able to learn, nearly all the plants were dismantled, and no thought was given to the future requirements—which might well have been fatal. While I am on this subject I need to stress to you all that regardless of how world affairs shape themselves in the coming year, let us for heaven's sake, finish this job while we are about it and not get caught again without powder, airplanes, and tanks.

Machine tools are, of course, a heavy item on the list. We are going to need the entire output of the industry for 1941 and with an increase to $450,000,000 or perhaps $500,000,000. When we consider that in 1933 the industry turned out products valued at about $130,000,000, this is a highly creditable performance, and I am told by Mr. Vance, and I know from my own contacts, that the industry is coöperating 100 per cent and is even subcontracting part of its output as there just isn't time to build new plants. I think I ought to say something here, namely, that industry owes a great debt to the machine-tool manufacturers for the development they have carried on despite the depression. No country builds strong, beautiful, and accurate machine tools like the United States, and I was not surprised when I saw in the paper that machine tools in the occupied part of France were quickly whisked away into Germany. I'll bet these, and the airplane motors, were the most valuable sinews of war obtained . . .

The defense program is being charged with a lot of things aside from getting out material. We are supposed to see that everybody gets prosperous making the stuff, from worker to stockholder, and it is sometimes difficult to figure out where all this benefit is to come from. We are told that labor is going to assert itself and materially increase its return for hours of work. Nobody seems to remember in this particular case that the motor and the transmission are part of the same chassis, and while I am constrained to admit that they might both be out of balance—too few revolutions in the one case and some poorly meshed gears in the other—they have got to pull together to make the buggy travel!

Recently an informal opinion of the Attorney General was given to the press telling us all what the law in the premise was. This was all right. We all know this and respect the law. At the same time it was implied, or at least to many people it appeared to imply, that if you were in violation of the National Labor Relations Act before the courts said you were, you were out of luck as far as working for the Government was concerned—and I think that's going too far. All of this is based on a statement adopted by the Commission that work carried on as part of the defense program should comply with Federal statutory provisions affecting labor wherever such provisions are applicable. This means to me that when the courts have held that labor practices followed by a manufacturer violate the laws of the land, then, as a matter of policy only, defense contracts should not be given to that manufacturer until he changes his practices, and that's all it means to me. Certainly, the Defense Commission has no authority over, and does not want to undertake the job of, enforcing the labor laws.

My personal interpretation of the labor policy can be stated in very simple terms. The law gives labor the right to organize and prohibits the manufacturer from preventing such organizing activities. This is all right—I don't dispute it. I have no objection to collective bargaining or to committees as long as they restrict their activities to their prescribed field, but I don't want to go beyond this. The idea that a job in a plant entitles its holder to ownership of the plant belongs in Russia and not over here. The idea that an emergency eliminates the right of labor to negotiate belongs in Germany and not over here. The idea of pressure groups on the side of labor or capital belongs nowhere, and certainly not over here. The slow-down is criminal and the strike is stupid, unless good and valid reasons are there for it. There is no strike that cannot be settled around the table when personalities and selfishness are washed out and everybody at that table knows their arithmetic; namely, that each week's loss of work that wins a nickel raise takes sixteen weeks' work to break even. I think also that the idea of one labor group holding that plain piecework or incentive systems are all right, while the other group says they are all wrong, should be straightened out.

ANOTHER item which I would like to present for your consideration is the price levels. We have without any question of doubt a high standard of living in the United States, and we ought to preserve it. However, recently a very highly respected organization presented a "research" report which prophesied that all prices were due for a first-class spiraling, meaning that costs were bound to go up, and as they say in airplane language, "the ceiling was unlimited." This of course can mean only one thing, and that is inflation, and inflation will have a very bad effect. I can remember in 1925 buying ten million rubles and ten million marks for ten cents each and sending these two pieces of paper to a friend of mine in the United States and asking him to light his cigar with them. American business as I know it has always been cost conscious and not price conscious. So I appeal to you—stick to your principles of holding costs down. Price spiraling only means raising the cost of the markers in the game and settling after the game for whatever the good old economic law of supply and demand says that the chips are worth.

We have before us a struggle between peoples—one bent on destroying the other, for what ultimate objective nobody knows. But one thing is sure, to defend one's homeland against aggression will always be a tremendous advantage in any kind of a scrap. It is still the most popular issue in anybody's war, and I for one feel that we will give a good account of ourselves if the time comes. The mind is what gets licked—not the body.

So all you gentlemen who represent fifteen hundred communities in the United States, give your country the help it needs—preach patience with the output of pieces and advocate speed on the tools and the buildings. Give your time to help your fellow manufacturer if he has a problem. This is an all-for-one show. The security of your home needs it—your country needs it—your democracy needs it. There may be something the matter with democracy but we wouldn't change it for anything else. This is our show, so let us go to it and get the stuff out!

Weapons and the Army

Speed of Production Is the Need of the Hour

By Robert P. Patterson*

TO THE Army Ordnance Association, national defense stands for munitions. Over the years you have devoted yourselves to a study of the production of ordnance matériel. In the past, when it was not popular to remind the nation of the vital part that munitions play in our country's security, you stood your ground and gave warning of the perils that go with weakness in armament.

You have concentrated on the ways and means of assuring to the nation a ready supply of arms in time of peace and in time of war. The Industrial Mobilization Plan bears the imprint of the constructive thought of many of your distinguished members. In our present program your members are in key positions. In behalf of the War Department, I am happy to acknowledge our debt to the members of this Association for the contributions they have made and are making toward the achievement of the armament objectives.

Industry has given us whole-hearted coöperation in carrying the munitions program forward. While the press speaks of such and such concerns having "won" contracts with the War Department, the fact is that in many cases the contractor did not "win" a contract. In many of our most important projects—the powder plants, the tank arsenal, the airplane engines—the Government was the party that took the initiative and asked a company qualified for the work to undertake it as a patriotic duty. And the response by industry to these appeals has been most heartening.

The demands for types of ordnance never have been what they are at present: guns for use in aircraft and for defense against aircraft; guns for use in tanks, as well as tanks themselves, and guns for defense against tanks; artillery guns and howitzers, from the heavies down to the 105's, 75's, and 37's; mortars, machine guns, infantry rifles, and hand grenades. As an old infantryman, I pay particular tribute to the Ordnance Department for its leadership in the development of the shoulder rifle. Whether it be the Spencer carbine of the Civil War, the Springfield of the World War, or the Garand of today, our standard rifle has always proved its superiority over contemporaries.

THE armament program has been well conceived and thoroughly worked out. The fighting arms have laid down their requirements. They know what weapons they want. The supply services, guided by the Industrial Mobilization Plan and aided by Mr. Knudsen and his associates, know how to fill the requirements. There is no uncertainty as to what is needed, no indecision as to designs.

A sharp line has been drawn in the War Department between production and experiment, just as it is drawn in industry. We lay stress on experiment, research and invention, but the experimenters must not be allowed to dictate changes in production orders. Occasionally, changes must be made while production is under way—a striking improvement is brought to our attention, like the leakproof tank in airplanes. In such a case we would be remiss if we did not change the design even in course of manufacture. Barring such exceptional cases, the rule is that designs are frozen when the contract has been made, unless the manufacturer assures us that the desired change will not delay deliveries in any manner.

Our task in procurement is simply to serve the man who is to do the fighting in the field—to furnish him with the best weapons that science and industry can devise and to see to it that the weapons are supplied in abundance.

Speed of production is the need of the hour. Whatever interferes with speed must be pushed out of the way. In the War Department we are resolved that red tape shall not delay us, that complicated and time-consuming procedures shall be simplified, that momentum shall be maintained in the placing of orders as well as in the acceptance of deliveries. When legal obstacles are encountered, ways will be found to remove them. You may depend on it that the national defense will not bog down by reason of administrative action.

Congress has responded to the need for speed in rearmament. It has not merely voted the funds; it has done away with a number of laws that stood in the way of accelerated action—laws relative to competitive bidding, laws prohibiting assignment of claims against the Government, laws limiting profits on contracts, and a number of other laws.

SPEED in industry is the other side of the picture. As to productive capacity there is no cause for concern; our industrial capacity is greater than that of all other countries combined. We can outbuild the rest of the world. But swiftness in production is the objective. It is true that it takes time to "tool up" and get into heavy production. And yet our experience in 1917 proves that the time schedules for deliveries *can* be beaten when our people are alive to the urgency of the situation and go at the task with inspired enthusiasm. In 1917 we had the spur of necessity. We have the spur of necessity now. Our country and all that it stands for—free institutions, free speech, free enterprise—are threatened by a combination of aggressors whose ambitions know no bounds, who will stop at nothing but force. Our speed of production of munitions and our continuance of present policies will be the answer to their threats.

Make no mistake about it, our national defense must be the primary business of the country. Ordinary commercial demands must take second place. If priorities are required for the prompt achievement of the defense program, then priorities will come. If any interests refuse conciliation, let them look at France, torn by factions until Hitler swallowed all factions. We come again to the time element: General Forrest said that the side won that "got there firstest with the mostest men." Let us "get there firstest with the mostest men" and the "mostest" guns—on sea, on land, and in the air. Any who doubt the reality of the danger should bear in mind what Archbishop Spellman said in Boston the other day: "It is better to have protection and not need it than to need it and not have it."

*The Assistant Secretary of War.
This is an address delivered at the Annual Dinner, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

Rearmament Progress

Statistics of the Current Program

As further indication of the steady progress being made by the Ordnance Department of the Army in the production of military armament, the following list of production contracts with private industry is published. Orders placed with Government arsenals and those below $25,000 are not included. These orders were placed during the period October 1 to November 30, 1940. For earlier orders under the military rearmament program the reader is referred to the two preceding issues of this journal.

Artillery Matériel and Components

Facility	*Amount*
Bartlett-Hayward Division (Koppers Co.), Baltimore, Md	$ 9,956,000.00
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa	96,250.00
Brill Co., J. G., Philadelphia, Pa	80,973.55
Finkl & Sons Co., A., Chicago, Ill	94,250.00
General Electric Co., Schenectady, N. Y	92,938.00
General Tire & Rubber Co., Akron, Ohio	157,056.00
Hannifin Manufacturing Co., Chicago, Ill	384,279.61
Ken-Wel Sporting Goods Co., Utica, N. Y	57,635.90
MacKintosh-Hemphill Co., Pittsburgh, Pa	42,241.41
National Forge & Ordnance Co., Irvine, Pa	139,633.23
National Pneumatic Co., Inc., Rahway, N. J	178,300.00
Otis Elevator Co., Yonkers, N. Y	2,722,679.96
Ransome Concrete Machine Co., Dunellen, N. J	146,893.50
Struthers Wells-Titusville Corporation, Titusville, Pa	127,000.00
Waterbury Tool Division (Vickers, Inc.), Waterbury, Conn	126,078.00
Warner Electric Brake Co., Beloit, Wis	28,040.58
Western Austin Co., Aurora, Ill	240,280.00

Artillery Ammunition and Components

Aluminum Company of America, Pittsburgh, Pa	$ 49,776.00
American Brass Co., Waterbury, Conn	247,020.38
American Car & Foundry Co., Buffalo, N. Y	6,040,000.00
American Forge Division (American Brake Shoe & Foundry Co.), Chicago, Ill	440,000.00
American Metal Co., Ltd., New York, N. Y	43,350.00
Anderson Manufacturing Co., A. & J. M., Boston, Mass	1,570,800.00
Armstrong Cork Co., Lancaster, Pa	822,000.00
Armstrong Cork Co., Pittsburgh, Pa	770,084.00
Atlantic Manufacturing Co., Philadelphia, Pa	33,504.00
Atlas Manufacturing Co., New York, N. Y	71,681.30
Austin Powder Co., Falls Junction, Ohio	142,790.00
Automatic Machine Products Co., Attleboro, Mass	591,294.00
Babcock Printing Press Corporation, New London, Conn	607,500.00
Barium Reduction Corporation, South Charleston, W. Va	107,900.00
Bauer Brothers Co., Springfield, Ohio	2,337,740.00
Bethlehem Steel Co., Bethlehem, Pa	1,475,000.00
Bohn Aluminum & Brass Corporation, Detroit, Mich	117,685.50
Bridgeport Brass Co., Bridgeport, Conn	2,567,205.00
Briggs & Stratton Co., Milwaukee, Wis	847,000.00
Budd Wheel Co., Detroit, Mich	9,726,355.00
Carter Carburetor Corporation, St. Louis, Mo	1,335,535.40
Case Co., J. I., Racine, Wis	4,634,500.00
Cincinnati Ball Crank Co., Cincinnati, Ohio	195,456.99
Cleveland Container Co., Philadelphia, Pa	215,891.35
Cleveland Welding Co., Cleveland, Ohio	449,820.00
Crosby Co., Buffalo, N. Y	1,175,600.00
Cushman Motor Works, Lincoln, Nebr	582,600.00
Delco Products Division (General Motors Corporation), Dayton, Ohio	459,333.00
Doehler Die Casting Co., Pottstown, Pa	40,650.00

Ordnance Production Contracts

Facility	*Amount*
Dollin Corporation, Irvington, N. J.	$ 28,800.00
Eastman Kodak Co., Rochester, N. Y.	12,000,000.00
Eclipse Machine Division (Bendix Aviation Corporation), Elmira, N. Y.	78,000.00
Economy Fuze & Manufacturing Co., Chicago, Ill.	547,950.00
Edgcomb Steel Co., Philadelphia, Pa.	99,384.51
Electric Auto-Lite Co., Toledo, Ohio	1,101,299.80
Elwood Ordnance Plant, Elwood, Ill.	5,482,331.94
Emerson Electric Manufacturing Co., St. Louis, Mo.	822,232.00
Federal Screw Works, Detroit, Mich.	2,298,000.00
Fulton Sylphon Co., Knoxville, Tenn.	205,500.00
General Railway Signal Co., Rochester, N. Y.	4,375,000.00
Globe Machine & Stamping Co., Cleveland, Ohio	805,000.00
G. M. Co Manufacturing Co., Long Island City, N. Y.	84,900.00
Goslin-Birmingham Manufacturing Co., Inc., Birmingham, Ala.	1,740,000.00
Guide Lamp Division (General Motors Corporation), Anderson, Ind.	926,900.00
Harvey Metal Corporation, Chicago, Ill.	245,030.00
Hoover Co., North Canton, Ohio	3,923,300.00
Hurley Machine Division (Electric Household Utilities Corporation), Chicago, Ill.	755,590.00
Improved Mailing Case Co., Inc., Brooklyn, N. Y.	247,670.20
Ingersoll Steel & Disc Division (Borg-Warner Corporation), Chicago, Ill.	7,614,630.00
International Harvester Co., Chicago, Ill.	974,000.00
Iowa Ordnance Plant, Burlington, Iowa	8,207,488.20
Kingston Products Corporation, Kokomo, Ind.	508,000.00
Landis Machine Co., St. Louis, Mo.	769,100.00
Lansdowne Steel & Iron Co., Morton, Pa.	18,000,150.00
LeTourneau Co., Toccoa, Ga.	3,141,450.00
Link-Belt Co., Indianapolis, Ind.	232,350.00
Moline Forge, Inc., Moline, Ill.	496,000.00
Mueller Brass Co., Port Huron, Mich.	31,114.55
Mullins Manufacturing Corporation, Warren, Ohio	4,980,300.00
Murray Manufacturing Corporation, Brooklyn, N. Y.	2,035,000.00
National Cash Register Co., Dayton, Ohio	766,229.90
National Malleable & Steel Casting Co., Cleveland, Ohio	590,940.00
National Pneumatic Co., Rahway, N. J.	837,548.40
National Tube Co., McKeesport, Pa.	4,732,599.28
National Tube Co., Pittsburgh, Pa.	264,147.50
Norris Stamping & Manufacturing Co., Los Angeles, Calif.	49,080.00
Oliver Iron & Steel Corporation, Pittsburgh, Pa.	89,684.22
Omaha Steel Works, Omaha, Nebr.	2,955,750.00
Peco Manufacturing Co., Philadelphia, Pa.	40,000.00
Pennsylvania Smelting & Refining Co., Philadelphia, Pa.	26,400.00
Philco Corporation, Philadelphia, Pa.	2,098,600.00
Portland Forge & Foundry Co., Portland, Ind.	94,000.00
Pullman-Standard Car Manufacturing Co., Chicago, Ill.	2,825,030.00
Pullman-Standard Car Manufacturing Co., Butler, Pa.	1,590,000.00
Ravenna Ordnance Plant, Ravenna, Ohio	6,609,640.00
Revere Copper & Brass, Inc., Baltimore, Md.	34,774.84
Revere Copper & Brass, Inc., Chicago, Ill.	2,160,000.00
Schwitzer-Cummins Co., Indianapolis, Ind.	300,026.30
Scovill Manufacturing Co., Waterbury, Conn.	2,538,562.00
Smith Brothers Manufacturing Co., Findlay, Ohio	128,384.50
Southern States Equipment Co., Birmingham, Ala.	440,534.00
Spang Chalfant Division (National Supply Co.), Ambridge, Pa.	501,500.00
Stewart-Warner Corporation, Chicago, Ill.	1,926,979.00
Stockham Pipe Fittings Co., Birmingham, Ala.	571,200.00
Taylor-Wharton Iron & Steel Co., Easton, Pa.	2,721,240.00
Tennessee Coal Iron & Railroad Co., Birmingham, Ala.	5,823,600.00
Texasteel Manufacturing Co., Fort Worth, Tex.	1,195,000.00
Tredegar Co., Richmond, Va.	113,776.47
Triumph Explosives, Inc., Elkton, Md.	242,274.00
Tube Turns, Inc., Louisville, Ky.	668,610.00
Unique Specialties, Inc., New York, N. Y.	32,115.16
United States Automatic Corporation, Amherst, Ohio	53,388.50
United States Machine Corporation, Lebanon, Ind.	398,000.00
Ware Brothers Division (Chicago Roller Skate Co.), Chicago, Ill.	978,110.00
Webster & Co., Warren, Camden, N. J.	663,000.00
Weatherhead Co., Cleveland, Ohio	1,032,000.00
Westinghouse Air Brake Co., Wilmerding, Pa.	416,355.00
Willys-Overland Motors, Inc., Toledo, Ohio	8,820,040.00
Woods Machine Co., S. A., Boston, Mass.	2,347,344.00
Wright Machine Co., Worcester, Mass.	1,091,400.00

Ordnance Production Contracts

Facility	*Amount*
Wyckoff Drawn Steel Co., Pittsburgh, Pa	$ 31,758.06
Wyckoff Drawn Steel Co., Ambridge, Pa	115,460.00

Small-Arms Matériel and Components

Auto-Ordnance Corporation, Bridgeport, Conn	$ 3,185,354.13
Central Steel & Wire Co., Chicago, Ill	27,989.80
Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn	2,165,089.66
Crawford Manufacturing Co., Inc., Kansas City, Mo	38,557.81
Crown Cork & Seal Co., Baltimore, Md	1,147,030.00
Cunningham Sons & Co., J., Rochester, N. Y	294,600.00
Fischer Spring Co., Charles, Brooklyn, N. Y	157,800.50
Remington Arms Co., Inc., Bridgeport, Conn	213,253.01
Republic Steel Corporation, Massillon, Ohio	68,856.63
Universal Crusher Co., Cedar Rapids, Iowa	244,125.00

Small-Arms Ammunition and Components

American Brass Co., Waterbury, Conn	$ 1,728,303.50
Chase Brass & Copper Co., Inc., Waterbury, Conn	48,426.00
Globe Sales & Manufacturing Co., New York, N. Y	73,642.50
LaSalle Steel Co., Chicago, Ill	189,750.00
Remington Arms Co., Inc., Bridgeport, Conn	1,675,737.03
Revere Copper & Brass Co., Baltimore, Md	1,005,000.00
Schoettle Co., Edwin J., Philadelphia, Pa	130,350.00
Scovill Manufacturing Co., Waterbury, Conn	195,600.00
Western Cartridge Co., East Alton, Ill	2,150,000.00

Bombs, Pyrotechnics and Components

Atlas-Ansonia Co., New Haven, Conn	$ 484,000.00
Backes' Sons, M., Inc., Wallingford, Conn	148,435.00
Bridgeport Thermostat Co., Bridgeport, Conn	352,128.00
Briggs & Stratton Corporation, Milwaukee, Wis	1,673,910.00
Budd Manufacturing Co., Edward G., Philadelphia, Pa	705,293.00
Corbin Screw Corporation, New Britain, Conn	114,495.00
Delco Products Division (General Motors Corporation), Dayton, Ohio	445,656.40
Essex Specialty Co., Berkeley Heights, N. J	169,000.00
International Flare-Signal Division (Kilgore Manufacturing Co.), Tippecanoe City, Ohio	2,019,231.07
Krebs Manufacturing & Engineering Co., Chicago, Ill	27,823.75
National Fireworks, Inc., West Hanover, Mass	415,573.00
National Fireworks, Inc., Boston, Mass	312,320.00
New Jersey Fulgent Co., Metuchen, N. J	54,390.96
Noblitt-Sparks Industries, Inc., Columbus, Ind	352,073.20
Peco Manufacturing Co., Philadelphia, Pa	1,005,280.00
Pratt Industries, Inc., Frankfort, N. Y	236,241.75
Rheem Manufacturing Co., Chicago, Ill	122,612.50
Russakov Can Co., Chicago, Ill	129,000.00
Triumph Explosives, Inc., Elkton, Md	400,160.00
Unexcelled Manufacturing Co., New York, N. Y	756,736.00
Unexcelled Manufacturing Co., Reading, Ohio	427,000.00
United States Steel Export Co., New York, N. Y	150,832.00
Westinghouse Electric & Manufacturing Co., Springfield, Mass	944,000.00

Powder, Chemicals and Explosives

Baytown Ordnance Works, Baytown, Tex	$ 7,800,000.00
Du Pont de Nemours & Co., Inc., E. I., Carney's Point, N. J	567,950.00
Du Pont de Nemours & Co., Inc., E. I., Gibbstown, N. J	392,954.28
Du Pont de Nemours & Co., Inc., E. I., Pompton Lakes, N. J	28,800.00
Hercules Powder Co., Kenvil, N. J	608,007.40
Wannamaker Chemical Co., Inc., Orangeburg, S. C	61,000.00

Ordnance Production Contracts

Combat Vehicles, Automotive Equipment and Accessories

Facility	*Amount*
Allis-Chalmers Manufacturing Co., Milwaukee, Wis	$ 38,948.55
Cleveland Tractor Co.. Cleveland, Ohio	185,747.04
Continental Motors Corporation, Detroit, Mich	294,662.85
Eclipse Aviation Division (Bendix Aviation Corporation), Bendix, N. J	32,300.69
Ford Motor Co., Alexandria, Va	171,430.01
Goodyear Tire & Rubber Co., Inc., Akron, Ohio	47,951.16
Hydraulic Controls, Inc., Chicago, Ill	66,397.80
International Harvester Co., Chicago, Ill	664,734.96
Saginaw Stamping & Tool Co., Saginaw, Mich	289,599.80
Spicer Manufacturing Co., Toledo, Ohio	35,000.00
Titeflex Metal Hose Co., Newark, N. J	41,250.00
United States Rubber Co., Indianapolis, Ind	34,502.56
Vandyck Churchill Co., New York, N. Y	40,752.00
Weaver Manufacturing Co., Springfield, Ill	29,565.00
Wisconsin Axle Division (Timken-Detroit Axle Co.), Oshkosh, Wis	63,417.70
Wood Manufacturing Co., John, Muskegon, Mich	33,705.16

Fire Control

Bausch & Lomb Optical Co., Rochester, N. Y	$ 213,170.27
Eastman Kodak Co., Rochester, N. Y	5,997,944.71
Eclipse Aviation Division (Bendix Aviation Corporation), Bendix, N. J	1,970,119.88
Fairchild Aviation Corporation, Jamaica, N. Y	277,300.00
Gilbert & Barker Manufacturing Co., Springfield, Mass	1,635,287.35
Graton & Knight Co., Worcester, Mass	40,194.14
Marine Division (Bendix Aviation Corporation), Brooklyn, N. Y	36,417.75
Maxon Corporation, W. L., New York, N. Y	76,600.29
Merganthaler Linotype Co., Brooklyn, N. Y	3,172,154.87
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn	744,257.75
Safety Car Heating & Lighting Co., Inc., New York, N. Y	280,068.00
Sperry Gyroscope Co., Inc., Brooklyn, N. Y	3,630,291.25
Waltham Watch Co., Waltham, Mass	62,152.00

Tools and Machinery

American Cutter & Engineering Co., Detroit, Mich	$ 38,570.50
Brown & Sharpe Manufacturing Co., Providence, R. I	105,803.64
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	59,538.00
General Tool & Manufacturing Co., Irvington, N. J	28,500.00
Gibbs & Co., Thomas B., Delavan, Wis	300,000.00
Ingersoll-Rand Co., Phillipsburg, N. J	449,434.00
Jones & Lamson Machine Co., Springfield, Vt	135,310.00
Norton Co., Worcester, Mass	56,345.16
Pratt & Whitney Division (Niles-Bement-Pond Co.), West Hartford, Conn	95,010.00
Schutte & Koerting Co., Philadelphia, Pa	41,470.00
Shipley Machinery, W. E., Philadelphia, Pa	45,112.50
Studebaker Corporation, South Bend, Ind	25,000.00
Vandyck Churchill Co., New York, N. Y	40,752.00
Warner & Swasey Co., Cleveland, Ohio	183,645.00
Watson-Stillman Co., Roselle, N. J	49,400.00

Gages

Barwood & Co., Philadelphia, Pa	$ 136,830.00
Greenfield Tap & Die Corporation, Greenfield, Mass	41,985.58
Modern Tool & Die Co., Philadelphia, Pa	50,965.00
Pratt & Whitney Division (Niles-Bement-Pond Co.), West Hartford, Conn	31,762.50
Precise Tool & Manufacturing Co., Farmington, Mich	43,196.80
Precise Tool & Manufacturing Co., Philadelphia, Pa	26,164.80
Tools & Gages, Inc., Cleveland, Ohio	72,959.00
Vinco Corporation, Detroit, Mich	45,111.15
Wiedemann Machine Co., Philadelphia, Pa	47,320.00

Our Armament Goes Forward

The Gains in Planning, Engineering, and Production

By Maj. Gen. C. M. Wesson*

THIS night, one year ago, it was my pleasure to address the annual meeting of the Army Ordnance Association in Washington. At that time I conveyed my felicitations to you, expressing a deep conviction that your rôle in the then expanding rearmament program was one of prime importance. This conviction I have shared continuously for twenty-one years, and, as many of you know, I have reiterated it on countless occasions in all sections of the country.

Tonight I reaffirm that conviction with all the sincerity and earnestness of which I am capable. When I saluted you a year ago as co-partners in a tremendous defense effort, I thought, as we all did, in terms less weighty and less urgent than those of the present situation. Consequently, I welcome the opportunity to address you tonight, because I am thus afforded the pleasure of saying again, with redoubled sincerity and confidence, that your help in the present undertaking has heartened me beyond measure and has helped beyond estimate in the successful operation of our Ordnance program.

May I then, General Crowell, express my thanks to you, and through you to the members of the Army Ordnance Association, for your invitation to address this historic meeting. I am grateful for the opportunity to foregather with you again, both for the pleasure of being with so many old friends, and for the opportunity to speak before understanding people on the present state of our military rearmament. I have chosen as the title of my address "Our Military Armament Goes Forward." For, gentlemen, it *is* going forward, and I propose to speak plainly about it tonight.

Our military armament is going forward simultaneously on three separate, yet coördinated, fronts. It is progressing from the standpoint of a definite plan. It is progressing from the standpoint of engineering. It is progressing from the standpoint of production. On each of these fronts the attack has been measured, comprehensive, and direct. Best of all, these operations have been undertaken with a magnanimous spirit on all sides, and in this, gentlemen, lies our best assurance of success.

Students of warfare in all its aspects may evaluate in varying degree the various factors of any military success. But certainly no one factor of a great armament program is more important than the factor of *morale*. Napoleon's maxim, the moral is to the material as three to one, is applied always to the tactics of fighting forces on the battlefield. But I am confident that this maxim is just as true in the operation of a modern armament program. Indeed, I beg leave to amend the Little Corporal's maxim: Today, the moral is to the material as six is to one!

It is unbecoming on my part, as it is on the part of those of you who have shared in the achievement thus far, to emphasize too much the fact that the Army and industry have planned jointly for the past twenty years to face an emergency such as the present. Strangely enough, some people, who today are loudest in their charges that we are without a plan, are the very same people who, not many years ago, opposed any such undertaking.

THE progress we are making with the armament program —and it is a considerable progress—can be ascribed to the seriousness and determination with which the Army and industry have worked at industrial preparedness since the World War. I need not give you statistics on that. In fact, statistics would not prove the point, because the measure of our progress in planning in normal times is one of the intangibles of preparedness. You cannot chart such planning satisfactorily. You cannot represent it fully by graphs. You can measure it by only one yardstick. That yardstick is a composite of common sense and coöperation. I confidently believe tonight—standing in this place among hundreds of men who have worked on our industrial-mobilization plans for so many years and with such self-sacrificing devotion—here, in this presence, if I were to ask man to man whether our plans have been fair, sound, up to date, broad, and sane, every one of you familiar with them would respond affirmatively.

There was one great lesson that the World War taught us. Although that lesson was forgotten in many quarters, we of the Ordnance Department and you of the Army Ordnance Association never forgot it for one moment. This lesson taught us the necessity of industrial-mobilization planning. Together we have worked on it year in and year out. We have kept our decentralized system of operation in existence throughout the years. With the loyal help of industrial leaders we have sustained contacts with industry and the engineering professions in times when, with much opposition, our work was considered useless. No better proof of this exists than the incident of last July when the present mammoth ordnance program was presented to the Congress. Immediately it became known that an ordnance program totaling two billions of dollars was to be authorized, I called to Washington the civilian chiefs of our Ordnance districts and placed the problems involved squarely before them. Because we had planned well, these gentlemen were in a position to activate their organizations locally so that our basic Ordnance principle of decentralized operation could be put into effect at once. When, on September 9th, appropriations became available for obligation, the Ordnance organization was ready to go into action.

Let me digress here to greet a good friend of all of us who is present tonight—a man on this dais. I refer to one of the greatest Ordnance leaders of all time, Maj. Gen. C. C. Williams, Chief of Ordnance from 1918 to 1930. His contribution to the structure of industrial planning is now in more ways than one proving to be of priceless value. The doctrines initiated by him are inextricably woven into the fabric of our plan and organization.

Our planning is not a thing of last month or last year. It goes back many years. Its primary objectives are to obtain, with a minimum of confusion and with the least possible

*Chief of Ordnance, U. S. Army.
This is an address delivered at the Annual Dinner, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

disturbance of the existing order, the munitions of war in the shortest possible time. This time factor, now talked about by some as if it were something new, is to us, on the contrary, an old story.

READ the reports of my distinguished predecessor, Maj. Gen. William Crozier, Chief of Ordnance, 1901-1918, whom we are so glad to see here tonight. His was a voice in the wilderness in proclaiming the necessity for accumulating stocks of war matériel because of the time required to produce them.

That our needs should be foreseen and planned for well in advance of the time required is, gentlemen, a doctrine we of the Ordnance Department have understood for years. But it is a doctrine most people do not accept until stark reality dawns upon them! Traditionally we temporize with our strength. Other nations have had this same failing. The Greeks had a name for it—"Whistling in the dark"! With an understanding of its responsibilities and with the wholehearted coöperation of American industry, a sound plan has been constructed by the War Department. In these days the American people can be assured of that fact. We have not been caught napping—no matter who says so!

From an engineering standpoint, Ordnance policy and the record to date need critical examination. The freezing of armament designs always has been a problem. The tendency to strive for better and still better equipment is constantly pulling at cross-purposes with standardization for production. Production engineering being basic in all our designs, there comes a time when an emergency demands the prompt standardization of types and a firm determination not to change them.

Let me tell you that so far as the design and standardization of ordnance equipment are concerned, we are in an enviable position. Today, ninety-eight per cent of all our designs are standard. All these are ready for quantity production, and many of them at this moment are actually in quantity production. Contrast this with the World War situation when the great bulk of the design load had to be carried out after war was declared.

As old as military science is, there are new applications of fighting equipment from time to time. Tactics and weapons are undergoing changes at this moment. One of the first obligations of the Army of the United States is to equip our fighting men with the latest and best protective devices; therefore, we must continue the work of developing new standards, because warfare itself continuously demands them. This field, the American people can be assured, is not being neglected. Our program of research and development is going forward apace. We must be on the alert for new methods of production, for the use of new materials, for the application of new methods. Our laboratories in the fields of metallurgy, chemicals, automotive equipment, and electricity are hard at work under a greatly expanded program to see to it that our new designs and future practices utilize the very latest developments of science and industry. In this activity we lean heavily upon private industry both for the actual design of certain types of equipment and for the utilization of processes which are common both to the things of peace and those of war.

Now as to production: The 1939 appropriation of $50,000,000 for armament has been converted into guns and ammunition and tanks. The 1940 appropriation of $130,000,000 was promptly obligated, and production on this program commenced a few months ago and is rapidly increasing each day. The current Ordnance program represented by the 1941 appropriation has a money value of approximately $2,000,000,000. Three-quarters of this amount did not become available until September 9th, and today, one month later, approximately seventy per cent of the total program has been placed with industry and the arsenals. The great bulk of contracts not yet placed apply to the products of some fifteen new Government plants which will not be ready for operation for approximately one year.

In point of time we are at least six months ahead of our record in the World War; in contracts placed we are at least 500 per cent ahead. And this is exactly as it should be, because we have been studying for twenty years how to handle an emergency program, and if we are not far ahead of the commensurate World War record for which there was little advance planning, then indeed have our plans been in vain. Now our job is to use all available means to speed up production to a maximum. I may state with confidence that from my long experience as an Ordnance officer and from my knowledge of the history of the United States, our fighting forces, at this stage, never have had the relative degree of armament progress which now prevails.

Our six manufacturing arsenals have been largely equipped with modern machinery. They are now employing over 25,000 men, and are daily increasing their forces. During the past three months they have increased production in general about thirty-five per cent. In the World War it took over a year after war was declared to expand and equip several of them and to get production started. Our private contractors have taken hold, as is customary with American industry when confronted with a job.

IN conclusion let me say that it has not been without satisfaction to be able to report progess—decided, definite progress in the great task of rearmament. In this achievement credit is due many individuals and organizations. As Chief of Ordnance of the Army, I would like to thank Judge Patterson, the Assistant Secretary of War, and Mr. Knudsen, of the Advisory Committee to the Council of National Defense for their unfailing support and wise counsel. To the hundreds of representatives of industry and the engineering professions who have worked with unanimity of purpose toward the one goal, inexpressible credit is due. Let us continue the important work so generously begun. Let us do it in a continuing spirit of coöperation and forbearance. Let us, if you please, do it with a smile, ruling out any consideration but the national defense of the United States. At times the job may be irksome, at times delays are irritating, but after more than a year of ever-increasing demands for armament and yet more armament, I say that this job has the united support of the entire country. Under such circumstances our armament program cannot fail!

Hence I offer as our slogan for the days that are ahead "Our military armament goes forward," and as a sustaining power I give you these lines of J. Mason Knox, fashioned after Kipling:

"It ain't the guns or armament, or the money they can pay,
It's the close coöperation that makes them win the day;
It ain't the individual, nor the army as a whole,
But the everlastin' teamwork of every bloomin' soul."

Ordnance Procurement

Munitions for Defense against Total War

By Maj. Gen. James H. Burns*

AMERICAN industry is now involved in a munitions program to the value of some fifteen billions of dollars through the combined procurement programs of the Army, the Navy, and Great Britain. This amount already exceeds the total cost of the Army for the World War, including pay of personnel, and the end is not yet in sight. Of this total program, approximately forty per cent is for the Army, and of the Army's portion, over one-third is for ordnance.

Except for the time factor involved, the program would not be too difficult, although it does represent the work power of perhaps 10,000,000 persons for one year. But the Army, the Navy, and Great Britain all demand deliveries at once, or as soon thereafter as possible, on a perfectly balanced delivery schedule. Each program must be coördinated within itself; all must be coördinated with each other, and each in turn must be coördinated with the needs of the home front.

The present output of munitions is valued at approximately two billion dollars a year, of which about half is for airplanes. The general speed-up necessary to accomplish the total objective of fifteen billions in permissible time is obvious, and in many specific cases in order to get synchronized deliveries the speed-up required is quite colossal.

In the case of most items of the program, existing capacity is negligible, for we have entered this emergency with practically no munitions industry except in the field of airplanes. We must, therefore, not only produce as rapidly as possible from existing factories, but we must build for production. We not only must build factories for the production of airplanes, airplane engines, guns, powder, explosives, and for ammunition assembly, but we must build factories for machine tools and gages and must even build factories for raw materials, such as ammonia and toluol. In all, we now face the construction of nearly one hundred such factories, either in toto or in major expansions. Congress already has appropriated to the Army $750,000,000 directly for new plants and plant expansions, and additional needs for the programs will bring the total to a figure well in excess of $1,000,000,000. (See editor's note at end of this article, page 344.)

In order to expedite our programs to the maximum, it is obvious that those responsible for them must so spread work throughout the length and breadth of the land as to utilize to the full, and as quickly as possible, the worth-while capacity of the country. By this means, choke points of work power, facilities, and materials are reduced to the minimum. The programs must be so controlled at headquarters in Washington as to make sure there will be available to the Army, at definite times and in sufficient quantities, not only the initial equipment and supplies but also the continued productive capacity necessary to maintain balanced combat units on a fighting status. This is the final test of accomplishment in so far as the military leaders are concerned.

The Ordnance program has been planned and is being executed in accordance with these principles. Production orders are being placed with industry as fully as possible through the fourteen districts into which the country is divided and through the Government arsenals. New facilities are being distributed throughout the country by means of special organizations in Washington, which know the whole problem. The program is being controlled by the Chief of Ordnance in Washington under the supervision of the Assistant Secretary of War and the National Defense Advisory Commission.

FOR this orderly procedure we must be thankful to many. It results in large part from Section 5a of the National Defense Act which requires comprehensive planning for the industrial mobilization of the country for war needs under the supervision of the Assistant Secretary and the Secretary of War. It was written into the law of the land just after the World War to eliminate the various weaknesses disclosed by World War experience. General Crowell was largely responsible for this legislation. We must be thankful to the various heads of the War Department, to the Ordnance Department and other supply branches, to the Ordnance districts, to the Army Industrial College, to the leaders of industry, and especially to the Army Ordnance Association for their continued efforts to make this law effective.

Today, there seems to be considerable public impatience with the speed at which preparedness is proceeding. As I see it, the situation is about as follows: In the first place, the all-important step with reference to any undertaking is the establishment of the objective, which must be definite, sound, and adequate. The War Department has defined its requirements by quantity, type, and time schedule. These requirements are based upon the most recent war experiences of Europe. They are adequate for the time being, for they will tax production effort of this country for many months to come. They are frozen, but not so rigidly as to prevent changes which are really needed.

It is true that the present total objective has been reached through a number of steps which critics can say should have been taken all at once and many months ago. From the hindsight point of view, such action would have been superb; but would America have supported such a program before the fall of France? When all points of view are analyzed, it is believed America can feel satisfied that our present program was adopted about as quickly as public opinion and the democratic processes permitted.

The next step in carrying out the munitions program is to put industry to work. The test here is the speed and efficiency with which orders are placed. On June 13, 1940, the War Department received appropriations for munitions totaling some $950,000,000. On July 10th, it received $600,000,000, and on September 10th, $4,000,000,000. Of this total amount, awards already have been made totaling some $3,400,000,000, or 61 per cent. The corresponding Ordnance figures are $350,000,000, $200,000,000 and $1,500,000,000. Of the totals involved, some 71 per cent have been awarded.

Not only are the production orders placed, but the facili-

---

*Executive to the Assistant Secretary of War. Major General, U. S. Army.

This is an address delivered at the Military Rearmament Round Table, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

ties orders are either actually placed or are so far advanced that in most cases plant operators have been selected and are proceeding with the preliminary work necessary to the initiation of the projects. In many cases, pending final agreements, contractors have been authorized to place orders for machinery and equipment, as these represent the choke points and long-time factors.

It was the opinion of many qualified observers that the War Department would do wonderfully well if awards could be made within three months of the time funds became available. This result is being obtained in spite of many new and unforeseeable difficulties imposed upon the War Department through changing laws and affiliated democratic processes. It is believed that America is justified in being pleased with the accomplishments of the War Department in general and with those of the Ordnance Department in particular, for the latter has the most difficult task and is in the lead in carrying it out. It should be appreciated also that these accomplishments have been achieved under hectic working conditions, inadequate office space, new, untrained, and inadequate personnel, and terrific public pressure, both from the standpoint of speed and individual consideration. It only could have been done by the hardest kind of work and effort.

THE third test of success is deliveries. The answer to this must be given with time. It depends primarily upon American industry. We can turn on the green light, remove speed limits, and endeavor to remove traffic jams, but in the long run it is the American industrial system that is on trial. America must not expect these programs to be delivered within a few months. Corresponding programs took both England and Germany some four years, and if America can cut this time factor in half she will have done a remarkable job.

Public demand and sound judgment both required that orders be placed as rapidly as possible. Early synchronized deliveries are, in turn, the final real objective. It was appreciated that all productive time factors involved were not equal. These two somewhat conflicting aims can be obtained only through control of the rates of production, and we are hoping that an adequate statistical control, supplemented by an effective priority system will accomplish this.

While it is believed that the munitions program is proceeding satisfactorily, it is not intended to indicate that no improvements are in order. Those responsible cannot be expected to comprehend perfectly all the problems and difficulties involved. Likewise, the organizations and those manning them are not perfect. We know many bottlenecks will develop. We must not rest on our oars but must drive harder and harder. We must get speed and still more speed. We can compromise on perfection and cost, but we cannot compromise on honesty and speed. The impatience of America, when kept within bounds, is one of our greatest assets, for it is a driving force of colossal power; but we must be careful that it is not allowed to become unreasonable and misdirected, for then it becomes very destructive.

In conclusion, I would like to emphasize that we are in the era of total war and the *Blitzkrieg*. These mean maximum destruction of enemies in minimum of time and correspondingly swift help to friends. They mean maximum productive effort of the country in the form of munitions and trained man power. They mean the elimination of luxuries and even the reduction of some of the essentials of the American standard of living. They mean maximum efficient work on the part of capital, management, and productive labor. The more rapidly we approach this total objective, the more secure America will be.

EDITOR'S NOTE.—One of our greatest military weaknesses always has been in our lack of production capacity for non-commercial items of armament, principally ordnance and chemical equipment. Aircraft production is equally vital but differs in principle because aircraft and their components (engines, propellers, frames, etc.) are commercial; guns, tanks, bombs, and ammunition are not. Thus, early in our present rearmament effort, General Burns, author of the above article, presented on behalf of the War Department, to the Congress the following program of plants (with estimated cost) considered necessary to be built to provide additional production capacity for a major war effort; *i.e.*, an army of 2,000,000 men.

ORDNANCE PLANTS

No.	*Purpose*	*Total cost*
4	Smokeless powder	$188,000,000
4	TNT	42,000,000
2	Tetryl	6,000,000
2	Picric acid and explosive D	8,000,000
2	Cotton purification	6,000,000
2	Ammonium nitrate	18,000,000
1	Ammonia	15,000,000
18	Shell and bomb loading: 75-millimeter; 155-millimeter	108,000,000
5	Bag loading	26,000,000
2	Fuze loading	10,000,000
2	Small-arms ammunition	7,000,000
6	Machine-gun and airplane cannon: Caliber .50; Caliber .30	36,000,000
1	Shell machining: 75-millimeter; 155-millimeter	8,500,000
2	Armor plate	8,000,000
4	Ammunition metal components	12,000,000
3	Proving grounds	28,000,000
6	Existing manufacturing depots	19,000,000
10	Existing Ordnance depots	12,500,000
	TOTAL: Ordnance Department	$558,000,000

CHEMICAL WARFARE SERVICE

1	Existing arsenal	$ 4,000,000
1	New arsenal	26,500,000
26	Commercial plants	9,000,000
	TOTAL: Chemical Warfare Service	$ 39,500,000

QUARTERMASTER CORPS

2	Existing manufacturing depots	$ 5,500,000

AIR CORPS (BASIS OF 50,000 MILITARY AIRPLANES A YEAR)

30	Airframe plants	$300,000,000
3	Engine plants	60,000,000
	TOTAL: Air Corps	$360,000,000
	GRAND TOTAL	$963,000,000

Antitank and Antiaircraft Guns

Trends in the Development and Use of Intermediate Artillery

By Brig. Gen. R. H. Somers*

IT IS noteworthy that the two types of weapons—antitank and antiaircraft—which I am to discuss are both functional types which appeared upon the scene during the first World War. The advent of the internal-combustion engine made the tank and the airplane possible, and these in turn made the development of counterweapons imperative. The problem of the antitank weapon is simpler than that of the antiaircraft gun and will be discussed first.

It seems to be generally considered by present European combatants that the prime necessity in overcoming a tank is armor penetration. Any projectile or sizable fragment of a projectile which gets inside a tank, coupled with the effect of fragments broken from the armor plate itself, will do sufficient damage to the mechanism and the crew to put the tank out of combat. Tank armor is remarkably resistant to the effects of high-explosive shell bursting outside the tank, and there is no point in trying to secure bursts inside, since a solid projectile gives better penetration than a shell and will as certainly put the tank out of action. Consequently, the present trend is toward solid projectiles.

The whole classic struggle in battleship design among the several elements of armor protection, fire power, and speed has its counterpart in present-day tanks. In turn, the progressive increase in the protection afforded by modern tank armor, because of both improved metallurgical practice on this armor plate and increased thickness, has made necessary a corresponding development of antitank weapons. The caliber .30 armor-piercing bullet is almost ineffective against any recent tanks, and even the caliber .50 bullet soon may lose its value relatively. The next larger calibers which have been given consideration for antitank use are the 20-mm., the 37-mm., and the 75-mm. In our service to date principal emphasis has been on the development and utilization of the 37-mm. gun.

The methods of fire control used by antitank weapons consist in the application of principles and methods which previously have been used by our land services. Ranges are comparatively short—generally not more than a few hundred yards. The targets are moving with whatever rapidity possible. No great refinement of apparatus is possible under battle conditions. Telescopes are single power and are fixed with their axes parallel to the bores of the guns. They are provided with graduated reticules by means of which the gunner can adjust his fire by observation. Tracers are provided in the projectiles to make observation easier.

The problem of attacking hostile aircraft is in an entirely different category. The advent of the airplane at once broadened the combat zone into three dimensions. No longer was it a matter of a more or less narrow, 2-dimensioned zone across which opposing forces struggled for mastery with whatever weapons were available. An entirely new target was presented, moving with a speed which has increased until today modern airplanes can travel as fast as 350 to 400 miles an hour.

Against such targets, all the old methods of controlling and adjusting fire were entirely ineffective. After a period of cut-and-try development, the director system of fire control has been evolved to meet bombing attack. The problem involves having three coördinates properly set at the gun at the moment of firing. The gun must point in the proper direction, it must be laid with the proper elevation, and the fuze must be set so that the projectile will arrive and burst at the position which will be occupied by the airplane several seconds after the gun is fired.

TWO principal and numerous auxiliary devices contribute to this end. We have a problem in trigonometry to solve. Every one knows that to solve a triangle we must know the length of at least one of its sides, and our first device must give us this information. This is done by a somewhat complex and highly refined optical instrument known as a "height finder." This is simply a military-type range finder with an added mechanism to translate automatically the rapidly changing actual slant range to the target into terms of the slowly changing height at which the target is moving. At the height finder we have two observers, each of whom follows the target through a telescope in the instrument; as long as they are accurately on the target and a third observer keeps the instrument adjusted to the distance of the target, the instrument gives a continuous reading of the height of the airplane above the ground. The reading is set on an electrical data transmitter on the height finder which causes the data to be transmitted to the next principal device—the "director"—where an index or pointer is caused to move to correspond to the height of the target. Here, no one actually has to read the data. An operator by turning a small handwheel causes a second pointer to move and keeps it matched with the one which brings the data from the height finder to the director.

With numerous planes in the air, it would be easy for the observers at the height finder and those at the director to become confused and to take observations on different airplanes. To obviate this, a device on the director automatically "repeats back" to the height finder the direction and the angular elevation of the target on which the director is set. This data is registered electrically at the height finder and serves to keep the two groups of observers on the same target.

Several tasks must be performed by the director before the data necessary to set the gun to hit the target in its future position are available. Allowance must be made for the speed of the airplane. Corrections must be made for wind, for the density of the atmosphere, for any variation in the muzzle velocity of the gun from standard, etc. The rapid movement of the target is allowed for and its future position computed by observers at telescopes attached to the director, one of whom keeps a vertical cross hair on the target by rotating the whole instrument about a vertical axis. Another keeps a horizontal cross hair on the target by rotating the

*Chief, Technical Staff, Office of the Chief of Ordnance. Editor of ARMY ORDNANCE, 1922-1925. Brigadier General, U. S. Army.

This is an address delivered at the Technical and Engineering Session, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

telescopes about a horizontal axis and in doing so sets into motion a train of mechanism inside the director.

The result of all of this is that the machine computes continuously and with high accuracy the three coördinates needed at the gun. No one has to read these data, however. They are sent to the gun automatically where three operators, by the same "follow-the-pointer" system mentioned above, set them off. The gun is thereby continuously kept pointed in the proper direction and laid at the proper elevation for hitting the target. The third coördinate, however, the setting of the fuze for the time of flight from the gun to the target, offers considerably more difficulty. No satisfactory device has yet been produced for setting the fuze with the projectile actually in the gun. The best that can be done at present is to set it outside the gun in a device known as a fuze setter. A certain time is required to take the round of ammunition from the fuze setter, insert it in the gun and pull the lanyard. This is known as "dead time." The data from the director which is sent to the fuze setter allows for the time it takes the projectile to travel from the gun to the future position of the target plus an estimated allowance for "dead time." This would be good if the "dead time" could be kept uniform. But inevitably this time will vary from round to round—gunners are human and their timing is not uniform. When it is seen that a difference of one second, with the target traveling 250 miles an hour, means a difference of over 350 feet in its position in space, it is apparent that the elimination of "dead time" is greatly desirable.

THE question of locating an aircraft target at night is immensely more difficult than the same problem in daytime. The principal method of doing this has been by means of an instrument known as a sound locator. This instrument consists, in effect, of two pairs of horns which conduct the sounds of an approaching aircraft to the ears of two observers, one of whom can turn the instrument about a vertical axis and the other about a horizontal one. This instrument operates upon what is known scientifically as the binaural phase relation principle. This means that, for a person with normal hearing, a sound affects each ear with equal intensity when it appears to come from a position directly in front. Each observer moves the instrument until he appears to be directly facing the source of the sound. It is to be remembered, however, that sound travels at a velocity of roughly 1,100 feet per second, and with an aircraft 20,000 feet away, the direction from which the sound appears to come will be very considerably behind the actual position of the aircraft. In order to compensate for this, the data from the sound locator are fed into another instrument known as an "acoustic corrector" which makes the necessary corrections for the travel of the aircraft during the time it takes the sound wave to reach the ground and then gives the instant position of the target. The aircraft having been thus located, the battery is ready to open up its searchlights and get it within their beams. This having been done, the problem of fire control is the same as in daylight.

The guns which have been used in connection with the methods described above have been the 3-inch, the 90-mm. and the 105-mm. guns, and their field has been that of attack against aircraft flying relatively high—15,000, 25,000 or 30,000 feet above the ground—and with the horizontal flight necessary in bombing operations.

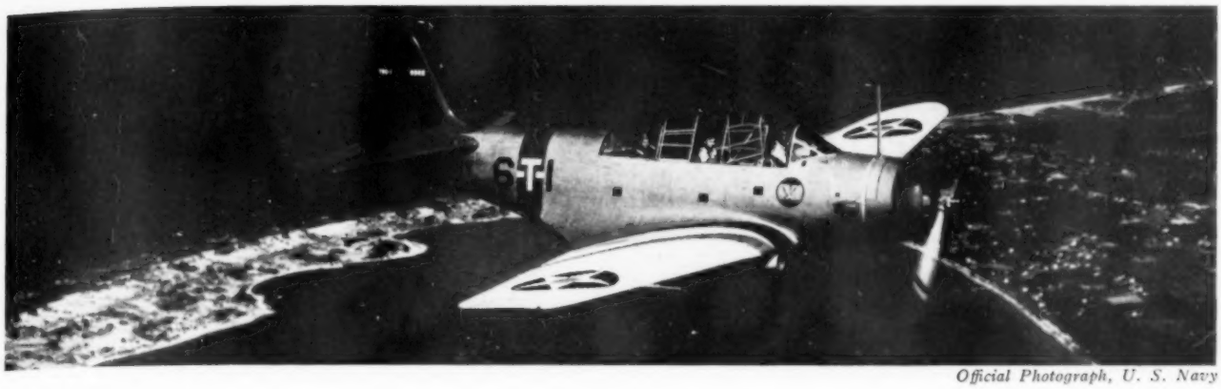
The classic time fuze is the powder-train fuze, and many of these are assembled to ammunition in our magazines. But the most recent fuze and by all odds the most accurate is the clockwork fuze. This consists of what is actually a small watch, with an escapement and train of the same sort as in any pocket watch, mounted in the nose of the projectile. It is arranged to start when the gun is discharged and runs for a predetermined time, set by the fuze setter at the gun, at the end of which it causes the projectile to burst.

THERE is still another branch of antiaircraft activity which is of increasing importance and which has not yet received anything approaching a stabilized solution. This is defense against low-flying aircraft such as the so-called hedgehopper and the dive bomber. Here we have very fleeting targets presented by high-speed airplanes so directed as to take full advantage of the terrain and hence arrive with the least possible warning. One method of firing against such attackers is that of individual sight control which has given fair results at times and which is still being developed. Another method is that of the use of tracer ammunition. This method seems to be fairly easy, since the line of flying bullets is visible and one can throw it on the target in the same manner a stream of water is directed from a fire hose. Unfortunately, it is practically impossible for the observer on the ground to tell what part of the trajectory is nearest the airplane and hence in what direction to move the sight. This difficulty is made worse because the brightest part of the tracer is closest to the gun. It does have a great advantage, however, in that it requires no apparatus and is instantly available as soon as the gun is fired.

An elaboration of this method is the central-control tracer method in which the sights of several guns are controlled by an observer placed in a position in which he can best observe the fire. A small control box is provided into which vertical and lateral estimated deflections are set off while observing the tracers, and these leads are transmitted by flexible shafts to the sights of the several machine guns in the group. The gunners then concentrate on aligning the sights directly on the target against which they are firing. This method yields considerably better accuracy than individual tracer control since the control box is not directly back of the guns, but it sacrifices the greater advantage of individual tracer control which requires no apparatus whatsoever. Because of the apparatus required, it is not available on the march but can be used only for firing in position. A fourth method that is now in the development stage is that of central control with computed leads. This is the most accurate of all methods under discussion when circumstances are such as to permit its use. Here leads, instead of being estimated, actually are computed by suitable apparatus.

Low-flying aircraft will be available as targets only for a very short time. It is necessary, therefore, to have extremely flexible guns to meet them. Guns such as our 3-inch and 90-mm. antiaircraft cannon, although entirely satisfactory to meet bombing airplanes, are entirely too slow and cumbrous to engage such targets. In addition to the caliber .30 and caliber .50 machine guns, we have developed an automatic 37-mm. gun and are developing a semiautomatic 75-mm. gun for this purpose. The standard projectile for attack of low-flying aircraft is a high-explosive shell with an impact fuze.

I have given but a very brief and rough outline of the present situation with respect to the two types of cannon which I have discussed. Development is going forward rapidly in several directions under the impetus of our rearmament. The picture a year hence may be very different.



Official Photograph, U. S. Navy

Building Our Navy

Industry Mobilizes for Defense Afloat

By Lewis Compton*

WHEN I received the cordial invitation from General Crowell to address the Army Ordnance Association, I welcomed the opportunity. There are two prime reasons for my genuine happiness in being with you today. The first reason is that in the Army Ordnance Association I recognize a group which has, through the years, kept alive a sense of concern for our national security, which, unfortunately, in this great country of ours, is sometimes lacking in periods of peace and prosperity. Your Association is the only civilian organization, to my knowledge, that has kept constantly before the people of this nation the necessity for industrial preparedness—a phase of our national defense so essential to our security. My second reason for feeling as I do about being here today is the pleasure derived from any joint endeavor with my friend and "Little Cabinet" colleague, the Assistant Secretary of War.

As you all know, it is through the medium of the Army and Navy Munitions Board, upon which I have the honor to serve with Judge Patterson, that coöperation and coordination are assured between the Army and the Navy in this important matter of industrial preparedness and the planning for the procurement of munitions. I can assure you that this medium is functioning very smoothly and very effectively.

If I may be pardoned for this slight diversion, I should like to tell you of a rather amusing incident which illustrates how smoothly and effectively the Army and the Navy cooperate. All of you, no doubt, recall some recent experiments with the so-called "Barlow bomb." On this occasion, Navy goats were to be used for the experiment. From "Ubiquitous Mr. Anonymous," a post card was received by the then Assistant Secretary of War, Mr. Louis Johnson. The card said: "It is highly appropriate that the goat—Navy's mascot—will be slaughtered in wholesale numbers by our brave and bloody American Army at Aberdeen, Md., on April 30, 1940." Mr. Johnson forwarded the post card to me with this comment: "I thought you might be interested in seeing the enclosed. The situation is even worse than you thought."

Now, to illustrate how the Navy coöperates, I replied to Mr. Johnson as follows: "I am unaware of any compelling reason for special comment concerning the slaughtering, under Army auspices, of certain Navy goats. While the Navy Department does not look with favor on such procedure, the force and effect of military custom is, in this instance, acknowledged without comment. The Army habitually gets the Navy's goat, but rather than risk friction within the armed forces, the Navy Department has adopted a temporary policy to keep on hand an adequate supply of goats to be expended, as necessary, to meet the Army's requirements."

It is my considered opinion that one of the prime lessons this nation learned from the last World War was the impossibility of winning any major war without the fullest cooperation of a prepared industry. I say "prepared" advisedly, because coöperation in itself is not sufficient. Both management and labor, to be fully effective in a major war effort, must have the "know how" which comes only from practice. A timely and splendid effort was made along this line by the War Department several years ago when they initiated the idea of so-called "educational orders" and obtained from the Congress the necessary authorizations and appropriations to place these orders with key industries. Prior to this, a great deal of splendid work was done in the development of the industrial-mobilization plan, which was based very largely on actual surveys of the industries essential in war.

IN so far as the Navy is concerned, a great deal of essential practice was obtained through the alteration, repair, and maintenance of the existing fleet and, since 1933, with the program of replacement of overage naval vessels. As our naval policy through the years has contemplated a Navy ready for immediate action, the Navy has been currently a more active organization when the volume of business which we do with industry is considered. Through the medium of the personnel of our field inspection offices we have been able, in the years since the last war, to gather the necessary data to provide the Navy's part of the industrial-mobilization plan.

With events moving as rapidly as they do in the world today, no policy or plan can remain long in a static condition. Events in Europe and Asia two years ago indicated the neces-

*Assistant Secretary of the Navy.
This is an address delivered at the Industrial Mobilization Luncheon, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

sity for a thorough checking of our plans. This resulted in a complete revision of the industrial-mobilization plan in 1939. Every effort is being made to keep this program up to date and abreast of the constantly changing conditions. In this day of sudden and undeclared wars, we would be derelict in our duty if we did not do so.

THREE years ago, in taking stock of the Navy's readiness to perform its mission and the adequacy of its plans for a major war effort, it became apparent that one of the phases of our program which needed strengthening was that of our industrial relations. It was found that the administration of some of our laws was working undue hardship on industry. It also was found that due allowance for the elements of equity and justice was not being made in connection with the administration of some of our contracts. Government contracts, as most of you no doubt know, must be very strict in order to preserve the integrity of the expenditure of the public money and to protect the Government against a very small minority of unethical and unscrupulous people.

I can assure you that every effort has been made in the Navy Department, and is continuing to be made, to base our industrial relations on fairness, forthrightness, and justice. This policy has shown results in the recent large-scale expansions with which we are now confronted. I can truthfully say that the Navy has had whole-hearted coöperation from industry. It is true that some industries—and with good reason—have been reluctant to accept national-defense business under the terms offered. There are, however, many, many examples where private industries were willing to put up their own money for necessary national-defense plant expansions for which there is no commercial use without knowing in advance just what the rules of the game were going to be. They had faith that their Government would do the fair and the right thing ultimately. As I see the picture, American industry only wants to know the rules of the game before the game is played rather than after it is over. It seems to me that industry is entitled to this.

It might interest you if I should cite a few examples of the extent to which private capital has financed plant expansion and facility additions in order that private manufacturing and shipbuilding concerns could meet the Navy's requirements. As of August 9, 1940, in excess of $4,500,000 had been so expended by the shipbuilding industry and over $8,000,000 by manufacturers of armor and fire-control instruments. I know of one concern that built a new plant, costing over $800,000, for the construction of a special type of high-speed motor torpedo boat for which there is no commercial market. All these firms spent their own money for these facilities and plant expansions without any closing agreements and without any assurance on the part of the Government of the rate of amortization they could expect in connection with the depreciation of these facilities and plants for tax purposes.

ANOTHER example of the coöperation of industry just came to my attention a few days ago. When the legislation to authorize and finance a seventy per cent increase in the Navy was first introduced in Congress, the Navy Department immediately began tentative negotiations with the shipbuilders and others for the ships and equipment required to meet this tremendous task. Through this use of foresight it was possible for the Navy to release letters and dispatches of awards for practically all the combatant tonnage authorized under this act within two hours after the President had signed the bill. Nearly four billion dollars' worth of contracts were awarded immediately. In doing this, we repeated what we did early in June when we placed under contract all the ships involved in the eleven per cent increase in the Navy within a few hours after the President signed the bill. Therefore, since the middle of June, the Navy Department has placed orders for in excess of five billion one hundred million dollars' worth of ships, ordnance, aircraft, and public works involved in the eleven per cent and the seventy per cent expansions authorized by this Congress.

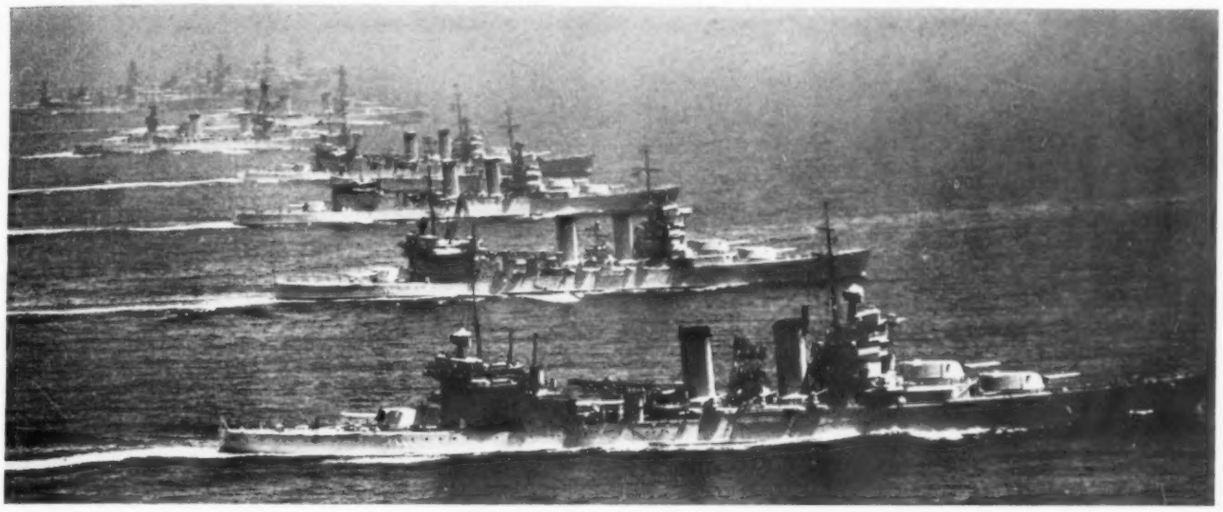
I recently have learned that industry, during this same period, also was using foresight. Through the design agent for three of the shipbuilding firms engaged in the building of destroyers, tentative orders were placed for all the boilers and for the main and auxiliary machinery for all the destroyers to be constructed by these firms. This was done on the initiative of the builders themselves and on their own responsibility. The result of this rather daring foresight was that, immediately they received their letters of award, they were able to send confirmation dispatches to the suppliers of material needed for the construction of the ships assigned to them.

IT is not only in the realm of material things that the Navy has tried to use foresight but also in the all-important question of personnel, both combatant and industrial. We have made every effort, consistent with legislative limitations, to anticipate our needs for both administrative and manual personnel in the Navy Department, in our field offices, and in our shipbuilding and industrial navy yards. Months ago we initiated an "in-service" and apprentice training program, which will provide, on time, the number of skilled workers we will need in addition to those obtainable through normal recruitment. We endeavor to keep approximately ten per cent of our total number of industrial employees under training. Facilities for the training of officers and enlisted men are expanding rapidly in order that we may have available the trained personnel necessary to man our growing fleet and air force. I might cite an interesting example of one phase of our procurement of trained combatant personnel. Within 18 days after we had the approval of the President for the training of 5,000 Reserve ensigns, we had 600 of these college boys physically examined, enrolled, and at sea on a battleship of the Atlantic Squadron. Since that time applications have been received and approved for the entire 5,000 contemplated in the original program.

In these trying times, a tremendous burden of responsibility rests upon the Army and the Navy for the security of our nation. In meeting this responsibility, the service organizations need the support and sympathetic understanding of the people of the country. It is through such organizations as the Army Ordnance Association that the truth of what we are doing can be brought to the attention of the people. I can assure you that every effort is being made, through the use of foresight and hard work, to accomplish the task before us. We are moving in a big way and have to move fast. In doing so, some mistakes are going to be made if they haven't been already. In order to avoid mistakes, we welcome constructive criticism and ideas. We only hope that in years to come the people of this nation will realize and appreciate the present urgent necessity for speed and make due allowance for any mistakes made. If we are going to preserve for our children the heritage of our fathers, we must prepare and do it without loss of time.

The Fleet

TODAY, despite the swift changes in modern warfare, the Navy is still America's "first line of defense." As long as the Navy stands ready to throw a protecting bulwark of steel and guns around our shores, the United States will be free from foreign invasion. The fleet is the heart of the Navy: bureaus, auxiliaries, and shore establishments exist but to serve it, for the fleet always must be ready to sail at a moment's notice to the defense of our national security, wherever threatened.



For elasticity in operation and administration, the fleet is subdivided into major forces: Battle Force, Scouting Force, Submarine Force, and Base Force. These forces also are subdivided into the categories of the various types of craft composing them—battleships, cruisers, destroyers, submarines, and aircraft. Each type, each individual ship, is designed for a specific function, for no one type can embody all the offensive and defensive characteristics essential to modern naval warfare: weight must be sacrificed for speed, and bulk for maneuverability.

The battleship is the backbone of the fleet. It is the largest, most heavily armed and armored mobile fighting unit. It possesses terrific fire power and is capable of resisting armor-piercing shells, aircraft bombs, submarine mines, and torpedoes, so that it may engage any hostile vessel it may encounter on the high seas. The United States now has fifteen battleships in active service with seventeen building.

All the smaller types of men-of-war are designed to enhance the effectiveness and improve the opportunities of the battleship. Cruisers range from 7,500 to 10,000 tons and mount 6- or 8-inch guns. They are marked by high speed and long cruising range and are employed in locating enemy forces, in raiding enemy commerce and protecting our own. The United States has thirty-seven cruisers with forty-eight building.

Destroyers, ranging from 1,200 to 1,850 tons, are equipped with torpedoes, depth charges, and guns up to 5 inches and may attack and destroy even the largest warship, depending on their high speed and maneuverability for protection. The United States has 159 destroyers (excluding the 50 sent to England) with 166 building.

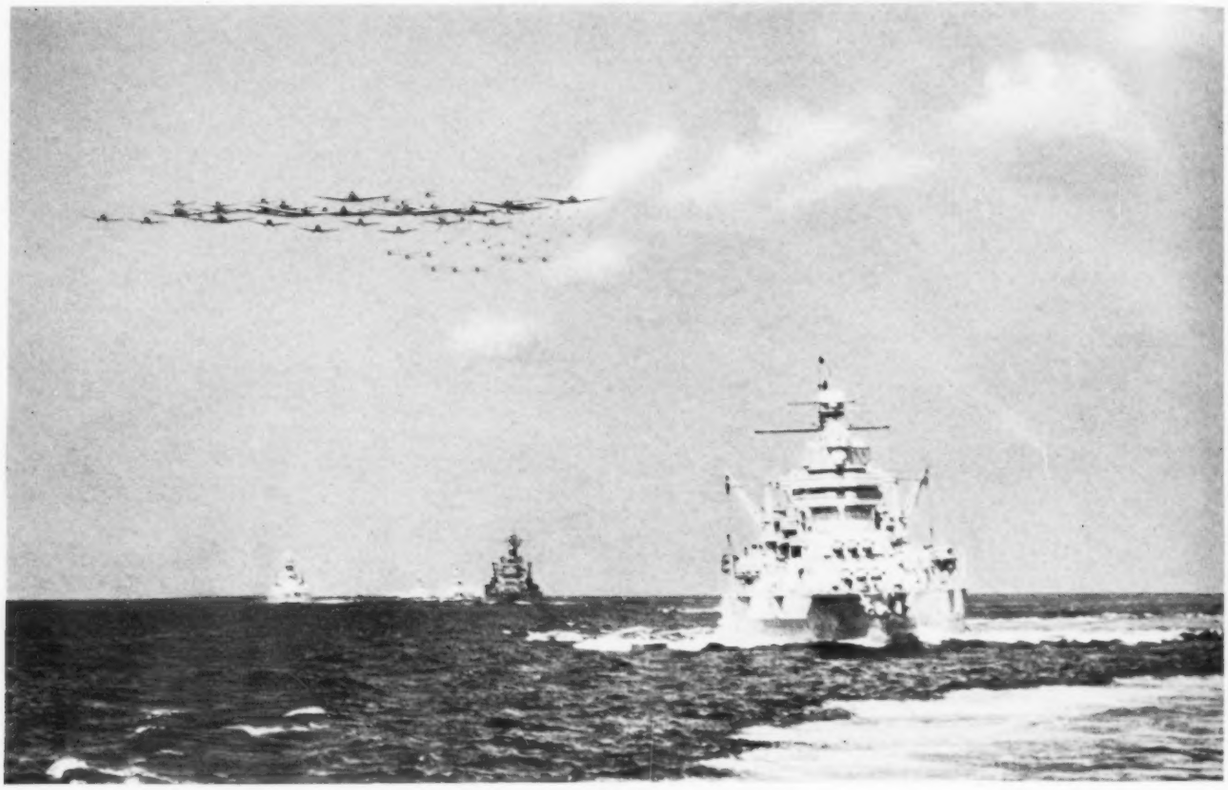
Submarines, armed with torpedoes, guns, and mines are used in locating enemy fleets, observing hostile coasts, harassing enemy trade, and attacking enemy warships. There are 104 U. S. submarines with 81 building.

Aircraft carriers are the floating airports of the Navy. They transport and service the various types of airplanes used in conjunction with the naval forces afloat. There are six of these vessels with twelve building.

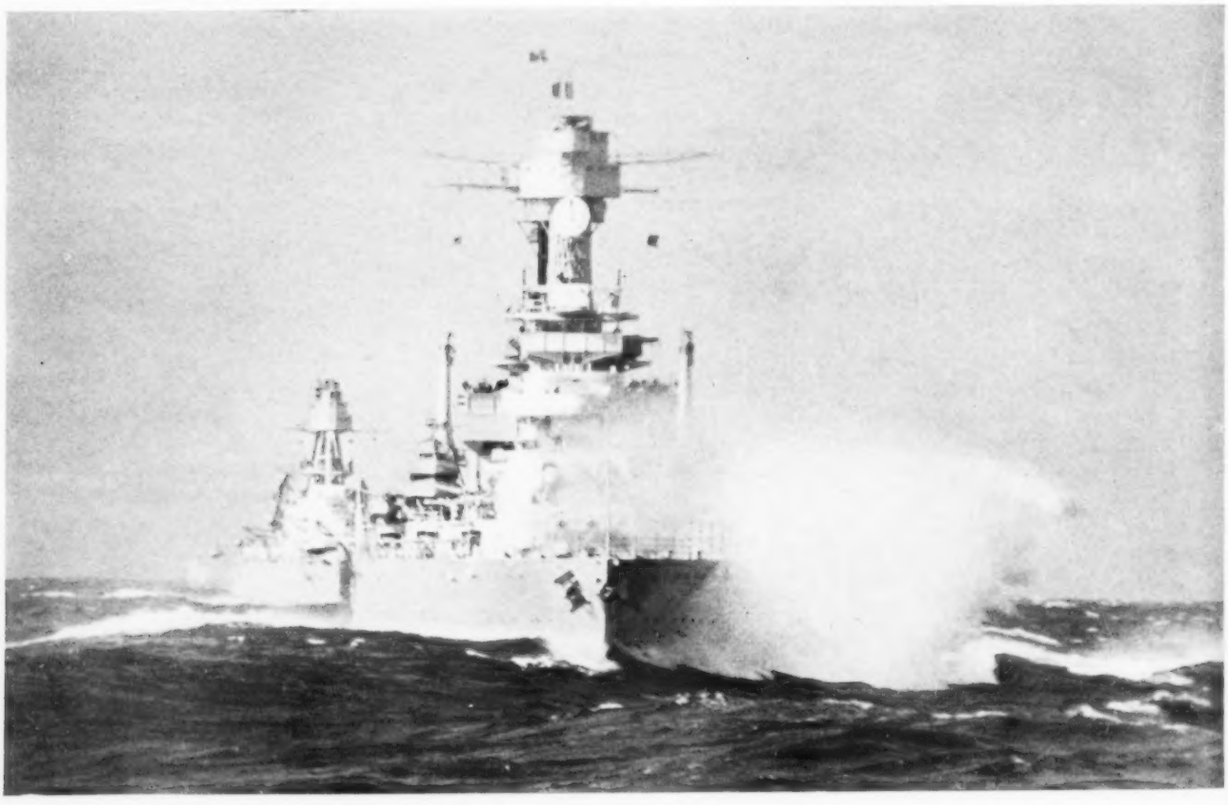
Newest addition to the fleet is the motor torpedo boat, aptly called the "mosquito boat." Designed principally for coastal defense, the "mosquito" is armed with torpedoes and is capable of very high speeds. Small and hard to hit, these little craft may prove deadly to the largest battleship.

A large number of auxiliary vessels are needed to service and supply these fighting ships. Such vessels include tenders, repair ships, cargo ships, store ships, oilers, ammunition ships, tugs, and hospital ships—all necessary for the strength of "our first line of defense." (All illustrations on this page and the following seven pages are from official U. S. Navy photographs furnished by courtesy of the Navy Department.)

Battleships of Our Navy



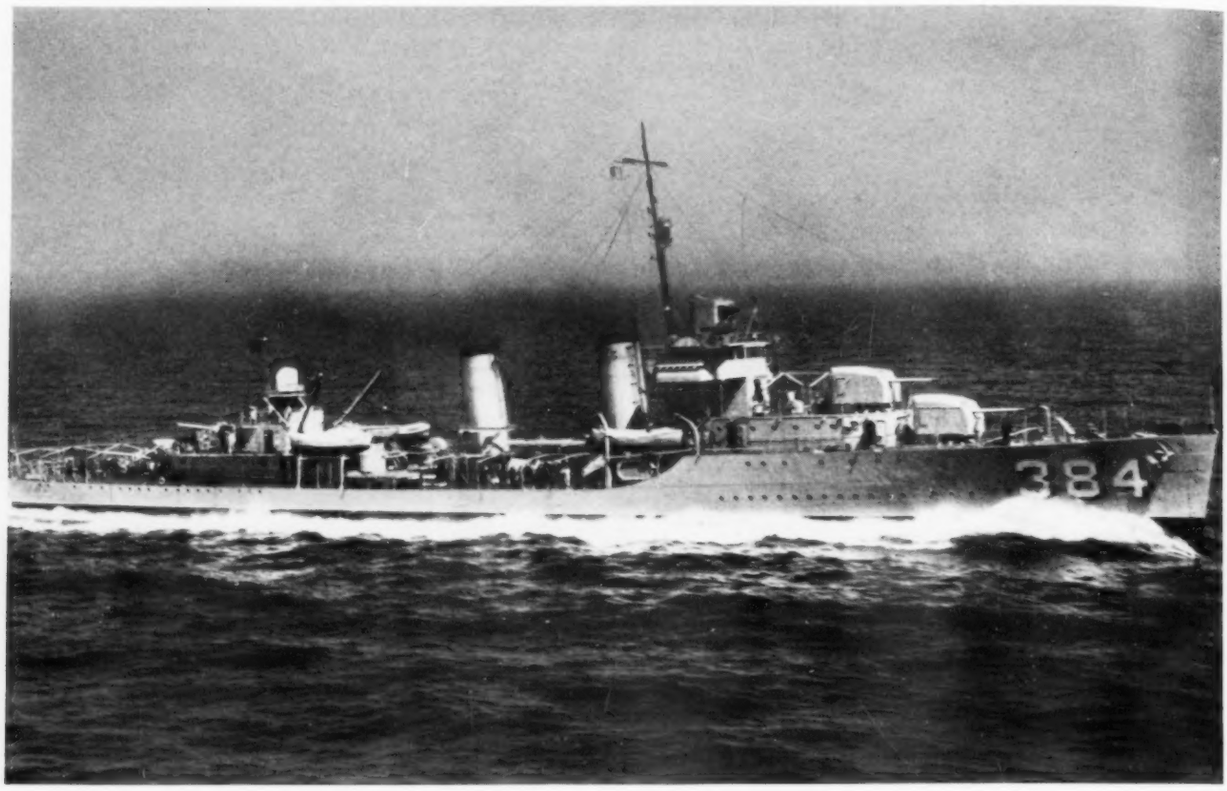
The battleship is the most powerful unit of the fleet and has the greatest defensive strength. It mounts guns of the largest caliber—up to 16-inch—and is heavily protected by armor plate against shells and bombs from above and torpedoes and mines from below. It also carries a strong complement of powerful antiaircraft guns to repel attack from hostile airplanes.



The Backbone of the Fleet

Battleships of the United States Fleet are vessels of from 26,000 to 35,000 tons displacement. They carry crews of from 746 to 1,633 officers and men. Despite their great size and weight, modern battleships are capable of speeds up to 30 knots an hour. A line of battleships is shown above with three protecting cruisers executing a swift maneuver in the foreground.

War Dogs of the Fleet

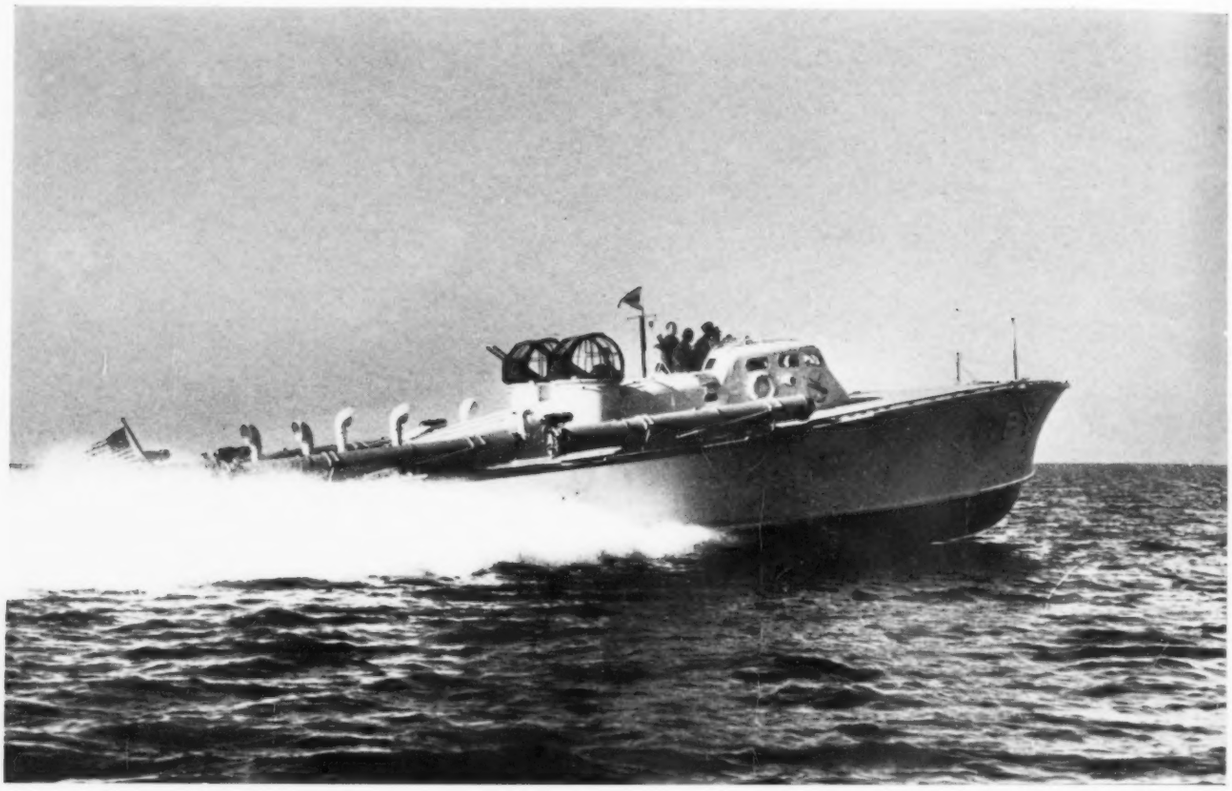


Destroyers are the tiny war dogs of the fleet, and despite their size are formidable men-of-war. Although lightly armored and dependent on their speed and maneuverability for protection they carry guns of 5 inches or less, depth charges, and their principal weapon—torpedoes. They carry crews of from 105 to 178. The DUNLAP *is shown above, the* MORRIS *below.*

Guardians of the Sea

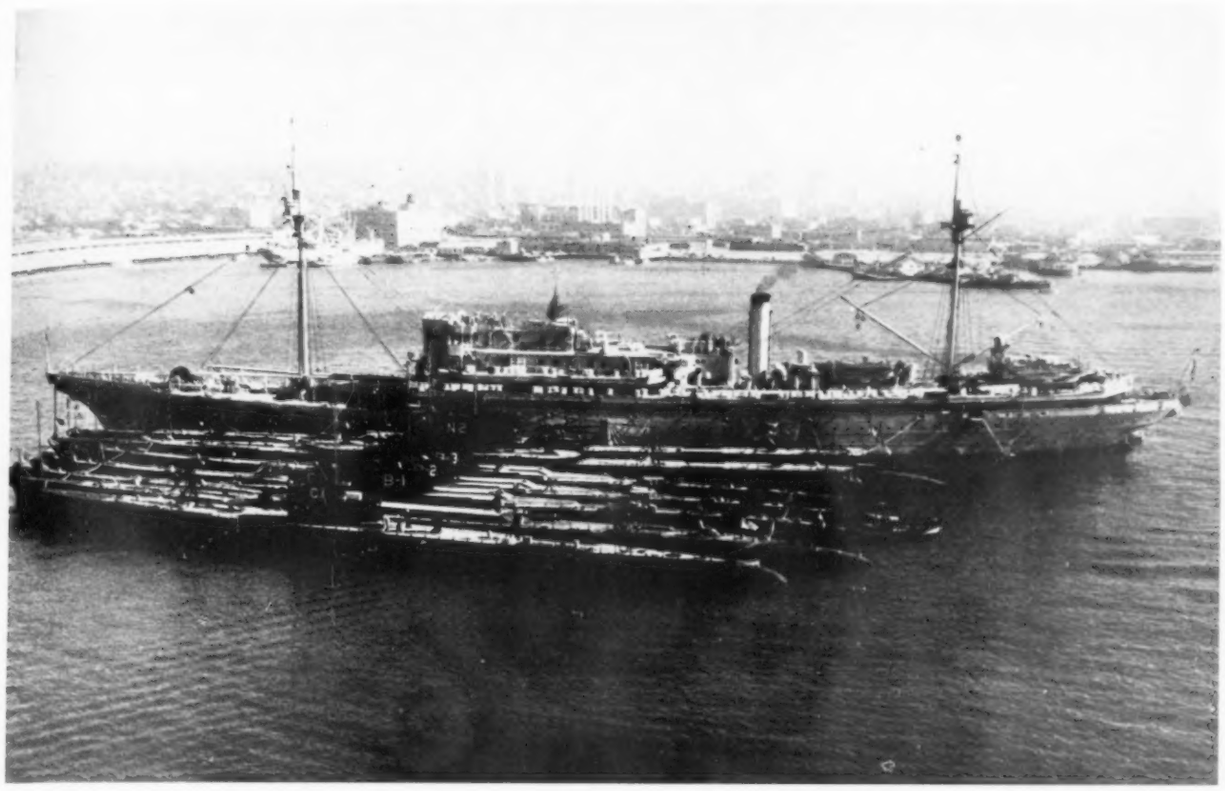
Cruisers are vessels of long cruising radius, high speed, and relatively heavy armament—mounting either 6- or 8-inch guns. The lighter cruisers are the largest vessels in the fleet which carry torpedoes. Cruisers also carry three or four seaplanes which are launched by catapult. Above, heavy cruisers are shown maneuvering; the cruiser HOUSTON *appears below.*

The Newest Torpedo Carriers



The motor torpedo boat, above, armed with torpedoes and machine guns, is the newest addition to the fleet. It is eighty-one feet long and carries a crew of ten. Capable of very high speeds, these "mosquito" boats can be used in coastal defense to attack vessels of any type. The submarine NARWHAL *(S.S. 167) is shown below on a surface run. Note the heavy guns.*

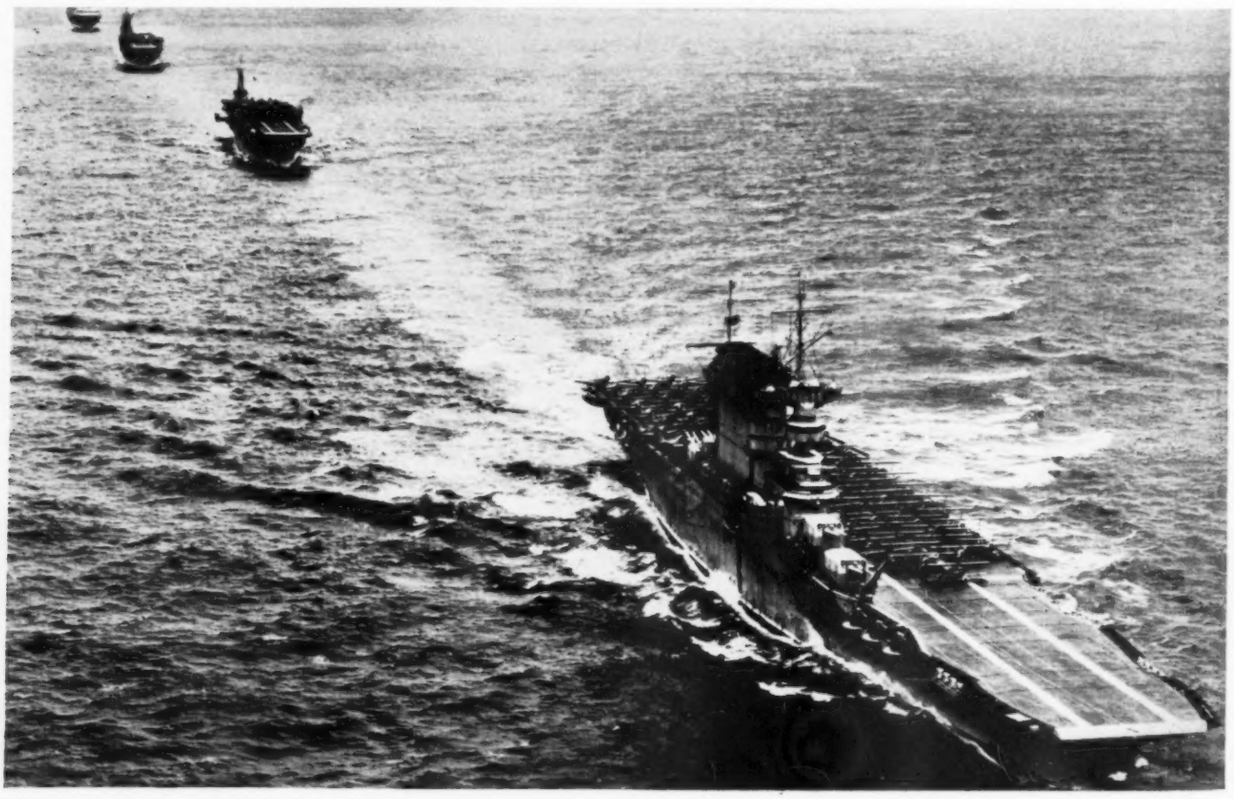
Undersea Fighters



The submarine tender U.S.S. HOLLAND *is shown above with seven submersibles alongside. The submarine* BONITA *(S.S. 165) is shown below. Submarines are armed with guns, torpedoes, and mines. In a fleet engagement their power may be used to attack major enemy ships. Defensively, they may be employed in patrolling our coasts and in planting mine fields.*

Air Arm of the Fleet

Modern aircraft have lengthened the strong arm of the Navy. In addition to dive bombers (illustrated above) the fleet employs fighters, bombers, torpedo planes, observation, scouting, and patrol planes—each designed for a specific function. Many of these base on aircraft carriers. Four are shown below: the LEXINGTON, RANGER, YORKTOWN *and* ENTERPRISE.



The Bases of National Defense

A General Survey of Our Military Assets and Liabilities

By Hoffman Nickerson*

TODAY when so many of the readers of ARMY ORDNANCE are absorbed in jobs immediately concerned with some particular part of the business of national defense, it is worth while to pause briefly and examine the problem as a whole. Although war and preparation for war are necessarily political acts in the sense that they are a part of the general policy of a government, let us try here to stick as close as we can to the technically military side of the matter.

Our starting point is the prospect of a future in which Prussianized Germany may dominate Europe—Hitler, however important, is at most a temporary incident in the long and consistent story of Prussian aggression from Frederick the Great through Bismarck to William the Second. There are, of course, degrees of domination. Even a victorious Germany might find her hands full near home: her new subjects might not be contented, and the effort of permanently holding down masses of unwilling subjects is enormous. Nor has Prussia yet succeeded in making willing subjects out of any non-German people. Nevertheless we and the great majority of our fellow citizens start from the premise that the armed forces of the United States should be strengthened and that promptly.

Where and for what we mean to use those forces we do not yet know. Here the political question bobs up again and must at least be briefly considered, for wars are simply acts of organized force by human groups pursuing contradictory policies. Some of us want to join the British. Others hold this to be unnecessary and unwise, insisting that we have problems to solve at home which are more important to us than those of Europe and that we should therefore confine our armed efforts to our own side of the Atlantic. Still others say that the question of our going into the present war is already academic, since the tempo of military operations today is too fast for us in our present unpreparedness to affect the result. In short there is a confusion of tongues in which only one solid fact is clear: whatever we mean to do, the speed of campaigns nowadays suggests that we do something which will be of use promptly.

"Promptly" is not immediately or tomorrow. We cannot be forced to act overnight, for we are in no immediate danger of invasion. Whatever we think of Colonel Lindbergh's recent speeches, on that point he is one hundred per cent correct. No educated soldier or sailor, if speaking his real thoughts frankly, will say otherwise. Even if a victorious Germany took over the uninjured British fleet, she can have no sufficient number of trained sailors and naval officers. Competent naval personnel cannot be improvised—their training takes time. Every one knows that the Italian fleet is designed for action within the Mediterranean and that the Soviet Navy is a joke. Japan seems to have her hands pretty full in China. It is a gross insult to our Navy to suggest that it would not give a good account of itself. Thanks to our naval policy for years past, there is no reason to fear that we could be rushed within the next few months, no matter what happens.

Consequently we need not indulge in the unmilitary quality of hysteria. We have time to think. In fact we are in little danger of invasion at any time, provided always that we keep ourselves reasonably prepared. Thus the time factor becomes more definite. The question is: How can we best develop our existing military assets, at least over the next six months? It would be better to say "over the next year."

NEXT, what branch or branches of our fighting services should we chiefly expand? Although geography compels our national strategy to be primarily maritime, yet any *hurried* efforts of ours must be chiefly on land and in the air. Our broad oceans, together with the weakness of our continental neighbors, make it impossible for us to fight a major war without either ourselves or our enemies having to put to sea in order to get at the other. The one exception would be another American Civil War—from which supreme affliction may God deliver us. On the other hand, a navy is even more difficult to improvise than an army. Large warships take years to build. As we saw in connection with the German fleet, the training of naval officers is a long business; without real knowledge of the complicated arts of navigation, marine engineering, naval gunnery, and fire control, they are not worth their salt. A few may usefully hold temporary commissions in the lowest ranks, say as ensigns and junior lieutenants.

Happily we need no disproportionate expansion in order to be formidable at sea, for the losses of the present war have made our war fleet stronger than that of any nation on earth. For such emergency expansion as may be desired, our Navy Department has carefully planned. Moreover the foundations for increased naval strength already have been laid. Much of our strong Coast Guard might be utilized. Neither our naval militia, nor our young college men who have had some training in the naval reserve, nor our large number of yachtsmen are wholly negligible. On the opposite side of the ledger, our merchant marine is none too large and is in bad shape as to personnel. A most desirable step toward improving our national defense would be to break the strangle hold which the C.I.O. has on most of our merchant sailors. In no field have the labor-coddling policies of recent years borne worse fruit. None the less, at sea we need be in no great hurry.

Thus, after thinking out the time factor, we can be clear as to which of our fighting services most needs rapid expansion and is best capable of it. Our rush job of national defense should concern itself chiefly with our Army, including its Air Force. Incidentally, no branch of our Navy has been more actively developed or has planned more thoroughly for possible expansion than our naval Air Force.

---

*Author: "The Inquisition, A Political and Military Study of Its Establishment," 1923; "Warfare" (with Spalding and Wright), 1925; "The Turning Point of the Revolution," 1928; "The American Rich," 1930; "Can We Limit War?" 1934; "The Armed Horde," 1940. First Lieutenant, New York National Guard, 1916; Captain, Ordnance Department, U. S. Army, 1917; duty with General Staff, A.E.F., 1918. Member U. S. Section, Inter-Allied Armistice Commission, Spa, Belgium, 1918-1919.

Returning to our main theme, an expanded Army would be useful even in case of a war in which most of the actual fighting was to be done by the Navy, for the stronger the Army, the stronger would be the bases from which the Navy must operate, and the threat of an American victory at sea would be more terrible to any enemy if there were a strong American expeditionary force ready to be launched overseas in order to exploit such a victory.

THE ultimate base of strategy, and indeed of national survival, is willingness to fight. While all armed effort and all endurance of danger depend upon the human spirit, this is peculiarly true of improvised or hasty efforts. Consequently, when we consider trebling or quadrupling our Army, before beginning to talk about weapons and training we must ask ourselves: Have we the spirit? Most of all, how about our young men? For it is they who must fill the ranks, man the airplanes, the tanks, and the guns.

I, for one, believe in our young men. Nevertheless we of the World War generation must confess with shame our negligences toward them. Ignoring the difference between mature and plastic youthful intelligences, we have regarded the widespread "treason of the intellectuals" with indifference and even with contemptuous amusement. Thus we have allowed the minds of the younger generation to be assaulted by mass attacks of the trashiest nonsense.

Let us take a few familiar instances. Recently President Roosevelt and his wife were conspicuously polite to a gang of youthful panhandlers calling themselves by the resounding name of the American Youth Congress, recruited largely from those whose ancestors were more noted for internationalism than for any national patriotism and banded together first to bluster and then to whine for government hand-outs.

Our education has been so spineless, so lacking in the power to develop judgment and poise, that tens of thousands of us, young and old, fell into panic only last year when a radio broadcast announced that men from Mars were invading New Jersey. Sometimes we have so ignored the necessary connection between Communism and crime as to put Communists in charge of our schoolrooms. Recently the intellects of some of our higher educators have wabbled into such a doddering pitch of insecurity that they no longer can distinguish between academic liberty and license—I refer to the shameful tenderness of a California college, of the New York City Board of Education, and of my own proud university of Harvard for Bertrand Russell, who has been branded in court as a public opponent of efforts to discourage some of the nastier forms of sexual vice.

It is no wonder, with such guidance, that not a few of our young men, tutored by us in almost everything but loyalty, are talking today as if they were a little soft in the head. But did not we, the young men of 25-odd years ago, talk a lot of somewhat different nonsense in our time? The answer is simple: We did. We too have paid more attention to gadgets than to Almighty God. There is a good story about a father who asked a boyhood friend: "At my son's age, was I as big a fool as he is now?" To which the other replied: "Yes, my dear boy, you were a lot worse." After what we have permitted our education to become, the wonder is that the number of soft-headed youthful pacifists is not far greater.

However, the pacifism of Americans, young and old, is only skin deep. Whatever else they may have become, our people have not turned cowards. By the time these words are printed, plenty of kids who yesterday were solemnly debating as to whether they would or would not fight to defend their country will have made haste to begin their training in arms. A typical case is a boyish editor of the school paper in a certain prominent school: A few months back he was so hipped about free speech that he printed a communication from a young refugee which was a gross insult to the A.E.F. of twenty-three years ago, but soon afterward he volunteered for a C.M.T.C. camp. Twenty-six years ago the spirit of Plattsburg was that of Valley Forge and Gettysburg and soon became that of the Argonne. Possible enemies take notice—we are one of the most combative peoples on earth!

ONE point alone perhaps deserves a word of warning. That is the indiscriminate use of the term "democracy." Of late years, American orators and writers have fallen into the habit of labeling whatever they like "democratic" and anything they do not like "undemocratic." Now many of the more thoughtful of our college undergraduates, among whom much of the best of our junior officer material is to be found, profoundly distrust the very word. Having read our Federal Constitution, they well know that it was meant as a barrier against pure democracy and that it still serves as such. Moreover, what they have seen of democracy in action does not impress them. A political and social system which for fifty years has steadily decreased the number of owners and steadily increased the proportion of proletarians, does not seem to them admirable. For them the vile cancer of proletarianism simply means that after graduation few peace-time jobs will be open to them. "If that be democracy," they say with some justice, "we don't think much of it."

On the other hand, they sincerely hate bullying and tyranny. They detest unprovoked attack by the strong against the weak. That is their political creed and it is enough.

Among the chief services that we can do for our defenders is to keep the professional propagandists from them. Since this is a time for plain words, instead of "professional propagandists" it might be better to say "hired liars." We shall not wholly succeed in curbing these people, for commercialized propaganda is today an inescapable part of life both in peace and war. Nevertheless we should do our best. Amid the stench of propaganda, let us tell as much truth and nail as many lies as we can. By all means let us do our best to mislead enemies and possible enemies, but let us not deceive ourselves or our soldiers.

TURNING from spiritual to more finite matters, we may at least congratulate ourselves—very modestly, to be sure—that both in available weapons and in the matter of training we are far ahead of where we were in 1917. Emphatically this does not mean that we are now prepared for a considerable military effort—far from it. It does mean that our preparation starts from further ahead of scratch than it did twenty-four years ago. Here those of us who know something of the real situation have an urgent duty to perform in informing our fellow citizens. If indifference and sloth are bad, excessive calamity-howling is worse: it spreads discouragement; especially it weakens confidence in our higher command.

The public ignorance as to the favorable features of our military situation today as compared with that in 1917 is startling. A few months ago the present writer was talking with a patriotic and highly cultivated man, the editor of a

long-famous American magazine, today one of the comparatively few American magazines which educated people still can read with pleasure. He was so impressed with our deficiencies in airplanes, tanks, antiaircraft guns and antitank guns that he obstinately refused to see the difference between the broomsticks or the wooden guns with which so many outfits had to train in 1917 and 1918 and our present abundant supply of infantry rifles as good or better than any in use in Europe today, not to speak of machine guns and 75's. When these points were urged, all he would say was "these left-overs from the last war do not console me." One hopes that he will never have the difference between a broomstick and a bullet from a 1903 Springfield, a 1917 Enfield, or a Browning gun proved on his own hide!

We need only compare the situation in 1917 when there was not even enough matériel on hand to train officers: At the first Officers' Training Camp at Plattsburg that year there was not one machine gun until a lucky individual—given forty-eight hours leave to inspect a newly born son—was able to borrow two guns from Eastern Department Headquarters and six more from public-spirited civilians. In 1918 some National Army divisions could not get either rifles or field guns until shortly before sailing for France.

Obviously the existence of abundant stocks of rifles, machine guns and 75's today permits industrial priority to be given to airplanes, tanks, antiaircraft guns and antitank guns. The general ignorance of the value of our stocks of weapons on hand is equaled, if not surpassed, by the ignorance of the Industrial Mobilization Plan and of the keeping alive of the private armaments industry by "educational orders." The present writer is in a sufficiently detached position to be able to say that the Ordnance Department and the Army Ordnance Association have been far too modest. Incidentally we must not forget that one reward for the patriotic men who labored in this field was to be called "merchants of death" by great minds like Senator Nye and certain smart-aleck magazine editors.

IN the matter of recruitment and training periods, since we are now committed to liability for one year of compulsory training for all between the ages of 21 and 35 who are not exempted, it is the business of all of us to do everything we can to make that system work. Nevertheless we should grasp the changing significance of universal liability for compulsory service. It is true that absolutely no serious military effort is possible today without such service. Those who do not understand this understand nothing about contemporary war. That such a thing is indeed lamentable has nothing to do with the matter. Obviously governments should not be demigods with unlimited power over the persons and purses of their subjects. They should be public utilities equipped with minimum powers and run for the benefit of those subjects. In the famous words of Cleveland, however, we are confronted by a condition and not a theory. If we mean to make sure of preserving our national independence, we must accept the temporary loss of individual liberty.

In the long run, the danger is more from within than from without. If we have a lasting determination to be crushed by neither dictatorships nor so-called democracies, then we may comfort ourselves with Lincoln's words: "In some severe illnesses you must feed the patient chiefly on aperients and emetics—but he never gets a taste for them."

At the same time it is important to realize that we do not need compulsory service for the old reason. That reason used to be the recruitment of a mass army built around its infantry and including most of the young and middle-aged manhood of the nation. A country which has had universal conscript service continuously for thirty years can mobilize about ten per cent of its entire population—roughly about one in five of its males. Thanks to foreign supplies, France in the last war is said to have slightly exceeded even this proportion. Ten per cent of our population would give us an army of thirteen millions, which is too absurd for discussion. For the moment one million—*i.e.*, less than one per cent—is, if anything, too many rather than too few.

Even in the conscript countries of Europe, the old idea of the nation in arms has everywhere given way to that of the nation in arsenals. The complexity and variety of modern weapons, their great power in highly trained hands, and their comparative impotence when handled by amateurs have greatly increased the value of military quality while correspondingly decreasing that of military quantity. Of course the infantry mass has some value; to criticize the Liddell Hart idea, which may be exaggerated into that of an army without infantry, would today be like whipping a dead horse. An effective army must be a balanced team in which all branches coöperate closely, and a considerable body of really good "infantry" is as indispensable as ever. None the less, the proportion of old-fashioned rifle-and-bayonet men has diminished considerably; many of the troops still called "infantry" are really light artillery armed with heavy machine guns, trench mortars, and antitank guns. More and more the function of the low-trained infantry mass is that of an army of occupation; at most it mops up after the enemy already has been bewildered and thrown off balance by the lightning attack of the highly trained specialized arms—airmen, tankmen, and mobile artillerymen.

TODAY the necessity for compulsory service is political and economic almost as much as it is military. There is no other means of emphasizing the universal obligation of patriotic duty. On the military side it has the inestimable virtue of assuring orderly continuance of essential civilian services while finding exactly the desired number of recruits at the desired time and backing them up with as many replacements as may be necessary. Still more important, however, is that compulsory service is a necessary first step toward a general war-time governmental regulation of wages and prices without which different sorts of profiteering—labor profiteering among others—might run amuck.

Being thus assured by our draft law of practically any desired number of recruits, we must next decide what number is desirable. Just as the quantity of weapons on hand still limits what we can do immediately, so the equipment of the highest number of men which we think we might require and could acceptably train is the goal at which the munitions program should aim. Here again we bump up against our ignorance of the sort of war for which we are preparing. Strategically speaking, are we merely to defend our own territory, together with the Caribbean, or the entire Western Hemisphere? Obviously "hemisphere defense" is a novel idea of which all the implications are by no means clear. Hemispherically or not, are we to send our fleet a great distance from our own shores? In that case we shall at least need small expeditionary forces to garrison advanced naval bases. Or must we consider the possibility of sending another large American expeditionary force overseas? To these questions, in early November, as yet there can be no answer.

Our search for some fixed point, therefore, leads us back to our existing Army and our recently adopted draft law. A few months ago our able Chief of Staff, Gen. George C. Marshall, testified before a Senate committee that without weakening our overseas garrisons in Panama, Hawaii, etc., we could promptly put into the field 75,000 seasoned Regulars, well, if not perfectly, equipped. Obviously these would be too few to contribute much to a major land campaign. At the other end of the scale we have at least two and a half million Springfield and Enfield rifles, about thirty-five hundred 75-mm. field guns, and a good supply of machine guns. Accordingly, our existing shortages of airplanes, tanks, antiaircraft guns and antitank guns would not prevent our giving basic training promptly to a large ground Army, always provided that other facilities and especially a sufficient number of competent instructors were available. Moreover we are compelled to rely largely upon numbers and upon weight of matériel, because the 1-year service provided for in our draft law prevents a really high training of our drafted men.

To discuss the details of our munitions program in a short article like the present would be out of place, but obviously such a program must be a large one. One last general observation about the manufacture of armament must, however, be made; namely, the high importance of the time factor and the difficulty in gauging it. Many articles of equipment present the question: Shall we rush the production of the existing item A, or have we time to consider the manufacture of the improved item A-1 or even the different and much better item B?

On this time factor the criticisms of our much-abused Ordnance Department in the last war were based—in so far as they were based on reason at all. At that, our errors, whatever they may have been, were small compared with those of nations far better prepared than ourselves. The Russian Ordnance Department waited so long to design and test an improved type of Maxim machine gun that they were only beginning to get their admirable product issued when their armies collapsed in 1917. The first French heavy artillery construction program was begun only in May 1916, although the Western Front had hardened into trench warfare in the autumn of 1914. This is not said to excuse mistakes but only to show the complexity of the problem.

The very successes in this field sometimes have been due to mere luck. For instance, the Germans in 1914 had much heavy field artillery because they thought that big guns would be effective in mobile warfare. They were mistaken—in open fighting the 75 proved superior, but when, contrary to the expectation of both sides, trench warfare began, their mistake proved a real advantage.

TURNING from ordnance procurement to training, the obvious limit to the expansion of a training program is the number of competent instructors. This raises the whole question of leadership and command, a question which must be discussed chiefly in terms of the Regular officers' corps and of the recruitment and training of a considerable body of new junior officers.

The National Guard is, in a sense, a separate problem. The present writer, having served in well-known outfits of two different States—first as an enlisted man, then as an officer—is clear that the Guard is primarily a military club. This is not said in disparagement—far from it. Only through such a club has the United States been able to get any substantial amount of military training done in time of peace outside the Regular Army. One of the chief inducements to serve in the militia has been the social life and activities which center in the armories. Citizen soldiers can give only a part of their leisure to soldiering. Moreover, much of the Guard is recruited from white-collar men in cities who have not the physical condition or the habit of exposure to bad weather which is common to those who live out of doors.

On the other hand, over and above the club aspect of the matter, most Guardsmen have a real interest in military affairs; not a few Guard officers are able men accustomed to a measure of leadership in their communities, and the crack Guard outfits contain much excellent officer material. If much of the Guard would benefit from a certain tightening of discipline, and if the chronic disinclination of Americans for soldiering in peace has compelled us to thrust these part-time volunteers a little too far forward in our general military scheme, nevertheless the existing organizations have real value, and a lessening of the age-old friction between Regular and Guard officers is greatly to be desired.

AS the Regular officers, who were junior officers drawn from civil life, must do most of the training of our new armies, let us first note whatever can be justly said against them. The chief defect of our permanent officers corps is that it is top-heavy. Through no fault of the individuals concerned, its relatively large numbers—about 12,000 as against about 227,000 Regular enlisted men, make it impossible for most of our commissioned personnel to have the chance to practice the primary peace-time work of an officer, which is to command enlisted men in numbers suitable to his rank. A few years ago it was calculated that, at any time, only seven per cent of our Regular colonels and lieutenant colonels of Infantry and less than three per cent of our Infantry majors could hope to command a proper number of enlisted men at maneuvers. In other words, the National Defense Act of 1920 gave us an officers' corps in which it has been physically impossible to determine whether the majority are competent troop leaders.

The only other general line of unfavorable criticism of our Regular officers is that West Point is perhaps just a little too much concerned with mathematics and the physical sciences and not enough with languages and the relation between military history and general history. The recent failure to promote certain officers who have distinguished themselves by study of the larger aspects of war may be a symptom of an undue distrust of the military "intellectual," leading to a failure to make use of his special gifts to the full.

Nevertheless, when we look at our Regular officers we have good reason to thank God and take courage. Their merits shine the brighter for just criticism and permit them to disregard unjust critics. A certain self-appointed military authority who recently wrote that Europe "laughs at" our Army, was merely talking twaddle.

The professional standard of our Regular officers is high. Although most of the great prizes of our society have gone to successful business men, so that many ambitious Americans have gone into business, nevertheless the interest of soldiering for its own sake has kept up the average of officer candidates. The modest economic security of Army life and the high standard of courtesy and good manners universally observed also have attracted desirable men. Naturally our officers are not perfect, but if anyone believes their general level of competence to be lower than that of, say, European

officers, he need only associate with French and British commissioned men in order to learn his error.

Let it not be forgotten that in 1917 our handful of Regulars had a better tactical doctrine than either the British or the French. General Pershing's wise decision to give all infantrymen some knowledge of the rifle before allowing them to be trained in the use of specialized weapons—grenades, trench mortars, or whatnot—was based upon the sound theoretical studies centered at the School of the Line at Fort Leavenworth. Perhaps the gravest error the Germans then made concerning us was their underestimate of the number of highly trained staff officers we possessed.

Amusingly enough, a certain German officer who visited Leavenworth not long before the last war is said to have paid little attention to what was going on there. Instead, so it appears, he spent his time in telling our people how the German Army did things.

IN the fundamental matter of discipline, those who served in France with the A.E.F., remembering the handful of about 2,500 commissioned Regulars distributed among over 2,000,000 civilians in uniform will echo the words of the late R. M. Johnston in "First Reflections on the Campaign of 1918": "The amount of stiffening which our officers' corps of the old Army succeeded in imparting to our Army in France was little short of marvelous. . . . Their faults, mainly the outcome of our system, were . . . obvious; their good points passed unappreciated among a mass of men too recently turned soldiers to estimate military things."

Today, our Regulars are better prepared than in 1917-1918 for the task of training the new armies, and that task, enormous though it be, will not be as difficult as it then was. In 1917 practically no Regular, except a few who had been inspector-instructors with the National Guard or had briefly commanded eager and intelligent Plattsburg training companies, had any experience of citizen-soldiers. Save for small wars in the Philippines, experience of active service had been limited to the Spanish War of 1898—an experience instructive chiefly in showing what should be avoided. Today, a considerable number either have served with the Guard or have trained C.M.T.C. recruits.

Moreover we have a first-rate asset in the men who successfully commanded troops in 1918. Journalists of the "generals-were-stupid-as-usual" school forget that the profession of arms can be fully practiced only in actual war. Imagine an experimental science like chemistry or physics in which all the laboratories were closed most of the time! Those who have felt the heavy responsibility of actual command are annealed as no other men are. Our present Chief of Staff, having been a personal aide of Pershing's in France, knows more about the problem of commanding great numbers in active service than any other officer now on the active list.

Next, our future commanders are exceedingly well informed concerning recent military developments. Since no one will question the importance of studying the new German methods, we may congratulate ourselves on having had at least two exceptionally able military attachés accredited to Berlin since the last war. While learning from the Germans, we have by no means taken over their ideas without adapting them to our circumstances. For example, the Germans have substituted a 4-inch howitzer for the old type of field gun of approximately 3-inch caliber. At the same time they have made coöperation between artillery and infantry more intimate than formerly, assigning guns permanently to all infantry units down to and including the battalion when engaged in mobile warfare. They have put these guns under the infantry commanders concerned, so that the infantry-artillery "combat team" is the standard tactical unit.

Our service, noting the usefulness of this reversion to pre-Napoleonic tactics, has adopted the combat-team idea which was first practiced in the recent Louisiana maneuvers. On the other hand, we have made no attempt to follow the Germans in dropping the old type of field gun for the light howitzer. Such a change would make our considerable stock of 75's worthless, and our High Command believes that comparatively inexperienced gunners are more apt to score hits with a flat-trajectory weapon than with one with a curved trajectory.

In saying that the task of training the new armies should at least be easier than in 1917-1918, the writer well knows that he runs the risk of being accused of underrating the colossal job ahead. Nevertheless, with a polite bow to the "nervous Nellies," he makes bold to borrow the vernacular phrase that the facts "stick out a mile."

OUR chief obstacle is the inadequate length of the 1-year training period. The German active divisions had two years' training and were able to spend their entire time in practicing with weapons and in combat exercises because their recruits already had been physically hardened and had received much basic training before joining the colors. In the Labor Service ("Dienst Aus Deutschland"), or in the Hitler Youth they had learned to drill, mess, and live in the open. Some of the photographs of Labor Service men parading with shouldered spades show a high standard of precise close-order drill with all that implies in the way of discipline and morale. Above all, these German recruits had learned to march amazing distances. Although the German Air Force and Tank Corps enjoyed most of the limelight, much of the credit for the German victories in the present war belongs to the infantry, not only for their fighting but also for their ability to march thirty miles a day for several days on end. If the reader will ask himself how many young Americans of his acquaintance in this motor-mad age could do the like, the only truthful answer will be "practically none."

Obviously, only high training is effective in lightning campaigns like those of the last fourteen months. Accordingly, we must regret that our 1-year training period will compel us, as we have seen, to rely more on numbers and on weight of matériel than we might desire. Nevertheless we have certain advantages which other nations, Germany for instance, have not. Besides being naturally combative, Americans are usually quick at learning new jobs. We have a higher average of mechanical skill and knowledge of motors than any other country on earth, a thing which counts heavily in these days of airplanes, tanks, and motor transport. While any continental European country must begin to build its mechanized forces by teaching people to drive, we have great numbers of competent drivers.

Further, we start from far ahead of where we were in 1917. First of all, the technical training of our officers was then thoroughly tested and proved good. Secondly, we have the experience of the last war to guide us. Thirdly, we are now beginning to train on a large scale at a time when we are still at peace—or at least in a state of nonbelligerency—a point which hardly can be overemphasized. Fourthly, we have in our Chief of Staff a rare combination of qualities—

an experienced, practical soldier who is also an accomplished student of war and a man of exceptionally clear and accurate mind. One needs only to read his testimony before recent Congressional committees in order to be impressed with his lucidity and his grasp of the main problems involved. Emphatically, he "knows what it's all about."

A GENERAL survey like the present would be incomplete without some mention of the Air Corps. The writer believes that a separate air force would be a mistake and that our national policy of keeping our Army and Navy Air Corps separate from each other and each respectively under the orders of the Army and the Navy High Commands is wise. The idea of an independent air force is justifiable only on the theory, first popularized by Douhet, of the omnipotence of the bombing plane. According to this Italian general, bombers, not acting in coöperation with surface forces but attacking hostile cities independently, can decide wars and may do so very quickly. Armies and navies should therefore be reduced to a minimum just sufficient for defense, and the greater part of the money available for military purposes should be put into airplanes.

As yet, both the available facts and the ascertainable trends contradict this theory. Airplanes have indeed developed enormous power in conjunction with ground armies. Acting somewhat like a new sort of artillery, they contributed largely to the German victories in Poland and in Western Europe. Similarly, temporary and local British air superiority made possible the successful evacuation of Dunkerque—apparently the retreating Belgians had effectively demolished their own airdromes so that German pursuit planes were momentarily unavailable while British pursuit planes operated freely from nearby British bases. On the other hand, the subsequent German air raids on England, although they have had a powerful effect by compelling the English to divert to the defense of their Island considerable military resources which would have been available for other purposes, have as yet conspicuously failed to obtain a decision. And this in spite of the enormous German superiority of position and in spite of odds of apparently three to one in numbers of airplanes. The comparative feebleness of independent air action can be judged from a single simple truth: had the Germans enjoyed a correspondingly numerical superiority in competently manned surface ships, the English long since would have been compelled to surrender. Indeed, in that case there would have been no war at all, for no English government would have been so insane as to fight.

ON reading the typescript of the foregoing article, a friend who is also a valued critic objects that there is no suggestion as to how our available officers might best be utilized. Let us therefore venture a suggestion.

Our officers' corps is "spotty." On one hand it contains successful combat leaders who in 1918 passed with honors the severest of possible military tests. On the other hand it has a deplorably high proportion of men who, through no fault of their own, have never had a chance to command troops even in peace.

A valuable step toward prompt improvement of national defense might be to list all the competent combat officers of the last war who are still of suitable age, including former temporary officers who wish to rejoin, and then put them through severe tests of their athletic condition and endurance of physical fatigue. Next, make them pass a hasty examination in the recent German military innovations and at the same time submit brief suggestions as to how this or that innovation might best be adapted to our own use. Finally, let all who passed both tests be put on a preference list for the officering of the combat units of our expanded forces. The temporary officers on that list might be given one jump in rank for the duration of the emergency and the Regulars, two jumps.

As to the physical condition of field commanders in modern war, it is worth noting that one of Germany's most successful "attacking generals," Von Reichenau, is a former Olympic athlete with the nickname of "The Bull." He is said to play remarkable tennis, and until the beginning of the present war he led his entire staff twice a week in regular 4-mile runs across country.

EDITOR'S NOTE.—In connection with the above study by Hoffman Nickerson—a regular contributor to these pages for many years—ARMY ORDNANCE announces with considerable pride the publication, on November 25, 1940, of his latest historical book "The Armed Horde, 1793-1939" (New York: G. P. Putnam's Sons, 427 pages, $3.50). Unfortunately, there was not time for a review to be published in this issue. The volume will be reviewed in the next issue.

"The Armed Horde" is a study of the rise, survival, and the decline of the mass army. Hoffman Nickerson's work is the first history of the mass army, originally invented by the French Revolution, which transformed war and remained the central figure of the fearful conflicts which are still with us. This sort of army, without which no maximum military effort can be made, is a social revolution in itself since it necessitates fierce popular passion and almost unlimited governmental power to tax and control everyone.

The author shows the rarity of the horde before the French Revolution, its reinvention at that time, and the strange chances which make it survive in spite of the invariable catastrophic results of every prolonged mass war: the Revolutionary-Napoleonic War, the American Civil War, and the World War of 1914-1918.

For ninety-nine years, from Waterloo to the Marne, Europe saw no long mass war. The horde was at first kept alive only by romantic military thinking and by the action of Prussia. After the rapid Prussian victories of 1820 the mass army was adopted by all Continental European powers.

The last two chapters of "The Armed Horde" discuss in non-technical language the search of military thinkers everywhere, since 1918, for more rational and more economical military methods, and the results of the new military theory in the opening phase of the present war. Without minimizing the gravity of the present situation, Mr. Nickerson finds—in the comparative bloodlessness of the operations to date and in the notorious and universal lack of military enthusiasm in all the fighting peoples—reason to believe that the mass army is declining.

Our review of "The Armed Horde" is being written by one of the leading military historians of the United States, Brig. Gen. Oliver L. Spaulding, U. S. Army, Ret., former head of the Historical Section of the General Staff and now lecturer in military history at George Washington University. Thus, ARMY ORDNANCE is fortunate in having an historian of note review a book which analyzes one of the greatest riddles of our time—democracy's demand for a type and degree of warfare which, unless they change, may be democracy's greatest threat to its own downfall.

Tanks

The Ideal Combination of Fire Power, Mobility and Protection

By Lieut. Col. J. K. Christmas*

MODERN warfare, like our modern life and industry, is mechanized. The tools of modern national defense are the fighting ship, the fighting airplane, and the fighting tank—developed in the order named. Each machine is supreme with regard to its respective element: the sea, the air, and the land. It is a source of great satisfaction to us that each is either an American invention or is based on American inventions.

This discussion concerns the fighting tank. Conceived by a small group of Englishmen and fostered by Winston Churchill twenty-five years ago when democratic nations were in danger, it is based on the track-laying tractor invented and developed in America. Developed slowly during twenty years of peace and grudgingly recognized in many military circles, the present war in one year has shown the tank or "land battleship" to be the master of the battlefield.

All fighting may be reduced to three essential tactical elements: fire power or "offensibility"; armor or "protectability"; and maneuver power or "mobility." It is interesting to note that for a long time fire power was far in advance of defensive power or armor protection. The advent of the internal-combustion engine, supported by the corollary development of the caterpillar track, brought the three elements of combat abreast. The perfectly integrated and synthesized product of these three is the modern fighting tank, which combines fire power, protection, and mobility in a single weapon or machine.

Let us seek to answer briefly the questions regarding the tank as a major element of our present national-defense program: What is it? What is it for? What is its value? How is it made? What are we doing about tanks?

The fighting tank is a completely integrated, balanced, and wholly self-contained fighting machine combining most of the means of modern science and engineering for the age-old purpose of beating our enemies on land swiftly, efficiently, completely, and economically. In a self-propelled vehicle which, because of its caterpillar tracks, can go almost anywhere on land quickly, we mount the finest of modern machine guns and artillery. A few highly trained men operate this powerful machine, and to protect the whole we surround it with armor plate. Inside the tank are also a powerful 2-way radio set, devices for protected periscopic vision, ammunition, water, rations, gasoline, and many modern devices to help the few skilled men in it to do very well mechanically what a great many men formerly did poorly and wastefully and at an enormous cost of drudgery, blood, and death.

Tank development has been hampered much by a lack of funds but more by a lack of comprehension best expressed by Admiral Mahan over forty years ago when he wrote:

"The student will observe that changes of tactics have not only taken place *after* changes in weapons, which necessarily is the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement of weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change."

THE mission of the tank is to replace man power with machine power in the work of our Army. The tank engine more than replaces man's tiny leg-muscle engine; the armor plate is, of course, better protection against bullets than human skin and a flannel shirt. It is particularly the duty of the tank to do two things: (1) the work men *could not do* before and (2) the dirty jobs which formerly were so bloody and wasteful of men. A modern light tank, for example, has the fire power of forty infantrymen, but exposes only four men to the possibility of death or wounds, and these four men ride behind armor that no pistol, rifle, or machine gun made can penetrate. Further, the light tank can move ten times as fast and march ten times as far in a day.

The special military value of the tank lies in the fact that it concentrates in one compact, balanced, and self-sufficient machine all the sprawling, complicated, and loosely organized functions of a muscle-propelled division—but the tank does it better. Machine-gun fire, artillery fire, the mobility of cavalry, the protection (but mobile) of trenches, antiaircraft fire, radio communication, rationing of man and machine for a long movement, transportation for the wounded, shelter against the elements, and transportation of accessory equipment—all these can be and are provided by one machine, the tank.

The special economic value of the tank lies in its relative cheapness. The tank gives more fire power, more mobility, and more protection to our fighting men per defense dollar than any muscle-propelled hand-labor military organization. A tank unit moves over seven times as far per dollar as a cavalry unit and can hurl from five to ten times as many pounds of bullets at the enemy per man employed on our side. That is efficiency!

Our tanks have been designed, developed, and built by the Ordnance Department, generously and ably assisted by our great automotive and other related industries, through such organizations as the Society of Automotive Engineers, as well as through the coöperation of many private firms. The Ordnance Advisory Committee of the S.A.E., under the chairmanship of Col. H. W. Alden, for over twenty years has worked with us in fair weather and foul. Of course, we get engines from engine builders, armor plate from the steel industry, rubber products from the rubber industry, and so forth; however, it is the work of the Ordnance officer and engineer to synthesize and integrate this knowledge, experience, and equipment into a complete fighting tank. A complete tank represents the work of many engineers and many firms. For example, our medium tank requires over 5,000 drawings, not counting the engine, instruments, and radio set.

We now have in our service a light tank of about thirteen

*Aberdeen Proving Ground, Md. Lieutenant Colonel, Ordnance Department, U. S. Army.

This is an address delivered at the Technical and Engineering Session, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

tons and a medium tank of twenty-five tons. These are now being made on a large scale by private firms. The firm now making light tanks is producing at a very satisfactory and increasing rate per day. This firm has principal subcontractors for finished components such as engines, transmissions, rubber tracks, and instruments. This does not count the raw materials contracted for, minor subcontracts, nor the subcontracts of the subcontractor. My point is that the manufacture of tanks rests on a broad base with roots reaching into almost every major productive industry in our country.

A tank contains or uses steel, nickel, brass, copper, aluminum, rubber, leather, glass, cotton, plastic, tin, lead, petroleum products, and explosives. Rolled plate, castings, forgings, rivets, bolts, wire, tubing, ball and roller bearings, gears, electric motors, instruments, electric lights, switches, batteries, valves, brake lining, and fire extinguishers are some of the components of a tank.

These fighting machines cost about $1 per pound, or $25,000 for the light tank and $50,000 for the medium tank. They are thus very much cheaper than airplanes and about on a par with fighting ships in cost. In real mass production the cost should be reduced somewhat, but the quality of materials and workmanship required precludes a reduction to the price of cheap motor cars.

It is reasonable to ask why we haven't gone into production on standardized designs more quickly. The answer is simple: The tank is a very new weapon; little money was spent on its development in the United States between 1920 and 1934, during which period only thirty were built; it is developing very rapidly, especially since the start of the present war in Europe.

LIGHT TANKS

Quality	*6-Ton Tank, M1917*	*Light Tank, M2A4*	*Ratio of Increase*
Gross weight (tons)	7½	11½	1.6
Speed	4 m.p.h.	37.5 m.p.h.	7.5
Armament	1 cal. .30 machine gun or 1 low-velocity 37-mm.	1 high-velocity 37-mm. & 4 cal. .30 machine guns	
Fire power (lbs./min.)	6.25 or 25.00	58.75	9.4 or 2.4
Radio, 2-way	No	Yes	
Crew	2	4	2.00
Cost (in comparable quantities)	$15,000	$25,000	1.7
Strategic mobility	Very poor (Approx. 50 miles)	Excellent (Approx. 2,000 miles)	20.00
Reliability	Very poor	Excellent	Many times

MEDIUM TANKS

Quality	*Medium Tank, M2-1*	*Medium Tank, M2A1*	*Ratio of Increase*
Weight (tons)	23	21	.91
Speed	10 m.p.h.	32 m.p.h.	3.20
Armament	1 low-velocity 6-pdr. 2 cal. .30 machine guns	1 high-velocity 37-mm. 8 cal. .30 machine guns	
Fire power (lbs./min.)	60	76	1.26
Radio, 2-way	No	Yes	
Crew	4	6	1.50
Strategic mobility	Very poor	Very good	Many times
Reliability	Fair	Excellent	Many times

TANK DEVELOPMENT SINCE 1917

WE are doing this about tanks: The American Car & Foundry Company is manufacturing for us large quantities of light tanks, and I foresee no problem in getting light tanks as fast as we need them. The Chrysler Company is building a plant for the Ordnance Department for the quantity production of medium tanks and is starting to produce tank components, while the Baldwin Locomotive Company and the American Locomotive Company have contracts to make medium tanks in their existing plants. While these firms are tooling up, the Ordnance Department is making some improvements in the design of our medium tank to incorporate recent war experience, but this redesign is not holding up production. By next summer we should be getting medium tanks in satisfactory quantities. A heavy tank of about fifty tons is under development; this is a renaissance of an old type in our service.

Meanwhile the Army is expanding and reorganizing its mechanized troops into an Armored Force, consisting initially of two armored divisions. These divisions are based on tanks as the principal weapon, whereas formerly the infantry was the "queen of battle." Artillery, infantry, and other troops are included in the armored division as auxiliaries to and in support of the main weapon, the tank. Each of these divisions will have 287 light tanks and 110 medium tanks, to say nothing of 275 heavily armed scout cars for reconnaissance.

This division of land battleships totals about 8,500 tons, which is about equal to one light cruiser in tonnage and in cost as well ($15,000,000). And, by and large, the production of these land battleships represents about the same technical skill, raw materials, and labor load on our industries as a light cruiser for the Navy. Since this armored division has about six times the fighting power of a muscle-propelled division, it can be seen what a relatively good national-defense investment it is. Another way to judge the cost of this division of tanks is to remember that its fighting machines will cost about $15,000,000 or the equivalent of 60 "flying fortress" 4-engined bombers.

A final word on costs: It requires several thousand dollars to support and train a soldier for a year before he is ready for battle. If he is wounded or killed there are further heavy expenses of hospitalization, compensation, and pension, quite properly payable to the man or his dependents. It is conservative to estimate that each soldier sent into battle eventually will cost us well over $10,000. As in industry, machinery can do the job much cheaper; therefore, tanks, which may appear expensive, are really economical because they save man power and reduce the moral disorganization of war.

Finally, as Americans let us not forget that industrial quantity and quality production as well as the operation of machines are our strongest weapons in war as well as in peace. Does some foreign power have four or five thousand tanks? We can and will, if necessary, cover the ground with tanks like swarms of locusts. When it comes to making or operating tanks we are dealing in skills in which the United States cannot be beaten. The production of tanks in quantity is one of the major defense assignments for our great industries—and one in which they will not fail.

The Vehicles of the Ordnance Maintenance Companies—Lig

MODERN Ordnance Maintenance Companies are the mobile service stations and repair shops for the weapons of the Army of the United States. It is their mission to keep the guns in firing condition, the tanks in good running order, the ammunition and bombs ready to fire. Ordnance maintenance companies are the up-to-date counterparts of the smith and his forge—familiar and essential factors of military organization from time immemorial.

The above schematic drawing gives a fair representation of the composition of the three types of Ordnance Maintenance Companies—Light, Medium, and Heavy. All are shown at war strength. The Light Maintenance Company consists of twenty-three vehicles of various types; the Medium Maintenance Company has thirty-eight vehicles; the Heavy Maintenance Company eighty-two vehicles. There are eleven types of repair and maintenance operations for which the vehicles are equipped: (1) artillery repair; (2) automotive repair; (3) emergency repair; (4) instrument repair; (5) machine shop; (6) small-arms repair; (7) spare parts; (8) tank maintenance; (9) tool and bench; (10) welding; (11) wrecking.

Every Ordnance Maintenance Company has several basic functions. The first and most essential of these is to repair damage to worn parts and to replace destroyed parts. The second function is to have available the necessary equipment with which to fit, adjust, machine or grind spare parts; in other words, to make upkeep practicable. The third function is to be prepared to offer general help to every other element of the Army which may need it.

Hence th
panies prep
tain genera
ard cargo
carriage ax
parts truck
dreds of sm
of ordnanc
on which r
work bench
mediate us
trucks with
repair by
service whe

Especially
tion of thes
power take

ce Maintenance Companies—Light, Medium, and Heav

TRUCK, EMERGENCY REPAIR ½ TON, 4X4
TRUCK, EMERGENCY REPAIR ½ TON, 4X4
TRUCK, EMERGENCY REPAIR ½ TON, 4X4
CAR, COMMAND ½ TON 4X4
MOTOR CYCLE WITH SIDE CAR
MOTOR CYCLE WITH SIDE CAR
TRUCK, SPARE PARTS 1 1/2-3 TON 4X4
TRUCK, SMALL ARMS REPAIR, 1 1/2-3 TON 4X4
TRUCK, WELDING 1 1/2-3 TON 4X4
TRUCK, MACHINE SHOP 1 1/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 1 1/2-3 TON 4X4
TRUCK, INSTRUMENT REPAIR, 1 1/2-3 TON 4X4
TRUCK, ARTILLERY REPAIR, 1 1/2-3 TON 4X4
LIGHT MAINTENANCE COMPANY
TRUCK, CARGO 1 1/2 TON 4X4
TRUCK, CARGO 1 1/2 TON 4X4
TRUCK, CARGO 1 1/2 TON 4X4
TRUCK, CARGO 1 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, CARGO 2 1/2 TON 6X6
TRAILER 3/4 TON
TRUCK, KITCHEN 2 1/2 TON 6X6
TRUCK, WELDING 1 1/2-3 TON 4X4
TRUCK, TOOL & BENCH 1 1/2-3 TON 4X4
TRUCK, SPARE PARTS 1 1/2-3 TON 4X4
TRUCK, SPARE PARTS 1 1/2-3 TON 4X4
MEDIUM MAINTENANCE COMPANY
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
CAR, COMMAND 1 1/2 TON 4X4
TRUCK, SMALL ARMS REPAIR, 1 1/2-3 TON 4X4
TRUCK, SMALL ARMS REPAIR, 1 1/2-3 TON 4X4
TRUCK, SMALL ARMS REPAIR, 1 1/2-3 TON 4X4
TRUCK, INSTRUMENT REPAIR, 1 1/2-3 TON 4X4
TRUCK, INSTRUMENT REPAIR, 1 1/2-3 TON 4X4
TRUCK, MACHINE SHOP 1 1/2-3 TON 4X4
TRUCK, MACHINE SHOP 1 1/2-3 TON 4X4
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, WELDING 1 1/2-3 TON 4X4
TRUCK, WELDING 1 1/2-3 TON 4X4
TRUCK, WELDING 1 1/2-3 TON 4X4
TRUCK, GAS & OIL 600 GAL 2 1/2 TON 6X6
TRUCK, GAS & OIL 600 GAL 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
HEAVY MAINTENANCE COMPANY

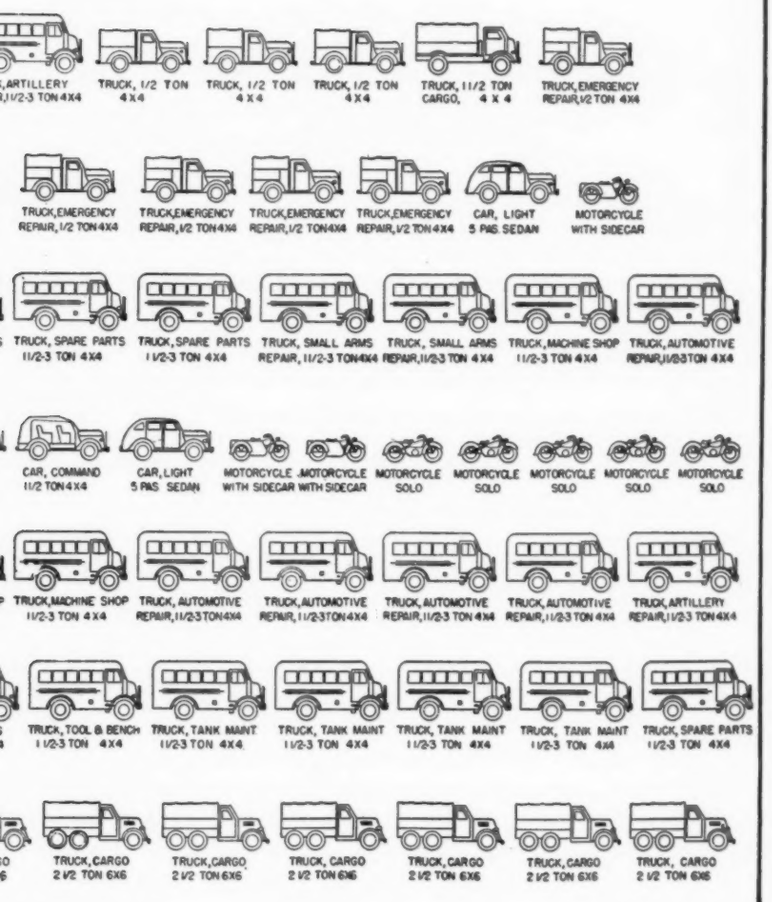
ntenance Company eighty-two
e eleven types of repair and main-
ns for which the vehicles are
illery repair; (2) automotive re-
ncy repair; (4) instrument repair;
p; (6) small-arms repair; (7)
tank maintenance; (9) tool and
ing; (11) wrecking.

e Maintenance Company has sev-
ns. The first and most essential
air damage to worn parts and to
parts. The second function is to
necessary equipment with which
hine or grind spare parts; in other
keep practicable. The third func-
ared to offer general help to every
the Army which may need it.

Hence the types of vehicles which comprise
panies prepared for these functions must hav
tain general characteristics. There must be s
ard cargo trucks for bulky parts such as
carriage axles, engines, etc. There must be s
parts trucks designed to transport the many
dreds of small parts needed for the mainte
of ordnance matériel. There must be shop t
on which machine tools, welding equipment,
work benches are installed and transported fo
mediate use. There must be emergency r
trucks with a roving mission which will faci
repair by rendering first aid to matériel o
service wherever it may be.

Especially noteworthy in the mechanical o
tion of these mobile repair shops is the use o
power take-off. Use of this system makes pos

d Heavy—at War Strength


TRUCK, 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, 1/2 TON 4X4
TRUCK, 11/2 TON CARGO, 4 X 4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
TRUCK, EMERGENCY REPAIR, 1/2 TON 4X4
CAR, LIGHT 5 PAS. SEDAN
MOTORCYCLE WITH SIDECAR
TRUCK, SPARE PARTS 11/2-3 TON 4X4
TRUCK, SPARE PARTS 11/2-3 TON 4X4
TRUCK, SMALL ARMS REPAIR, 11/2-3 TON 4X4
TRUCK, SMALL ARMS REPAIR, 11/2-3 TON 4X4
TRUCK, MACHINE SHOP 11/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 11/2-3 TON 4X4
CAR, COMMAND 11/2 TON 4X4
CAR, LIGHT 5 PAS. SEDAN
MOTORCYCLE WITH SIDECAR
MOTORCYCLE WITH SIDECAR
MOTORCYCLE SOLO
MOTORCYCLE SOLO
MOTORCYCLE SOLO
MOTORCYCLE SOLO
MOTORCYCLE SOLO
TRUCK, MACHINE SHOP 11/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 11/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 11/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 11/2-3 TON 4X4
TRUCK, AUTOMOTIVE REPAIR, 11/2-3 TON 4X4
TRUCK, ARTILLERY REPAIR, 11/2-3 TON 4X4
TRUCK, TOOL & BENCH 11/2-3 TON 4X4
TRUCK, TANK MAINT 11/2-3 TON 4X4
TRUCK, TANK MAINT 11/2-3 TON 4X4
TRUCK, TANK MAINT 11/2-3 TON 4X4
TRUCK, TANK MAINT 11/2-3 TON 4X4
TRUCK, SPARE PARTS 11/2-3 TON 4X4
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6
TRUCK, CARGO 2 1/2 TON 6X6

ARMY ORDNANCE, January-February, 1941 (Vol. XXI, No. 124)

comprise com-
nust have cer-
nust be stand-
such as gun-
nust be spare-
ne many hun-
maintenance
e shop trucks
uipment, and
ported for im-
rgency repair
will facilitate
atériel out of

nanical opera-
the use of the
nakes possible

reduction in size of the machine-shop and welding units, lowering of costs, simplification of equipment and the use of less costly trucks. The truck engine is the source of power for the operation of the generator needed on the machine-shop truck and for the welder on the welding truck. Use of the power take-off increased very materially the working space on the truck itself.

Detailed characteristics of the several types of trucks (spare-parts, machine-shop, welding, automotive and artillery repair, and emergency repair) were described in an article, "To Keep the Guns Firing—Equipment of the Modern Ordnance Maintenance Company" by Col. Donald Armstrong, Ord. Dept., U. S. Army, which was published in the September-October 1939 issue of ARMY ORDNANCE (Vol. XX, No. 116, p. 84).

Ordnance Engineering

Military Research and Development Looks to Private Industry

By Brig. Gen. G. M. Barnes*

A VERY large percentage of you gentlemen present here this afternoon already have accepted contracts for ordnance matériel. Thus, you have become partners of the Ordnance Department in the great effort for national defense. Before you can change these contracts and subcontracts into finished munitions you must obtain information from the Department, through drawings and specifications, as to what is to be made.

In thinking about this subject, my mind goes back to 1917 when I entered the Ordnance Office in the last great war. I found the office was engaged in making drawings of matériel to be manufactured, and great efforts were being expended in translating French and British drawings into American standards. Many months elapsed before information as to what was wanted could be given to manufacturers.

Fortunately, the main efforts of the Department over the past twenty years have been directed toward the development of new weapons. Today, the Ordnance Department has drawings and specifications covering the equipment to be manufactured. Perhaps the question has arisen in your minds as to how this equipment, which you will be called upon to manufacture, compares with similar equipment to be found in the hands of possible enemies. From tests of foreign matériel at our proving grounds and from the reports of experienced Ordnance personnel in Europe, we know that the equipment which you are to manufacture is modern in every sense of the word. In fact it would be found that, in general, American equipment is built to a higher standard than that of matériel used abroad.

In some cases, however, the drawings which the Ordnance Department will give you have not been tested by quantity production. Previously, appropriations have been so limited that the quantities manufactured up to this time also have been limited. However, if the matériel is manufactured in accordance with these drawings, weapons entirely satisfactory for field conditions will be obtained. Naturally, the Department wishes to keep to a minimum the number of changes which must be made; changes would interfere with quantity production. However, it is appreciated that some changes will have to be made to correct errors or to aid production, and often it will be possible to make changes in drawings or specifications without interfering with the functioning of the weapon in question.

While the equipment now under manufacture in connection with this program is modern and up to date, the Department does not intend to cease its efforts to obtain improvements. An extensive research-and-development program is now in progress, and effort toward the perfection of existing weapons and the development of new weapons will be accelerated. While research-and-development programs are normally carried out principally at the six Ordnance manufacturing Arsenals and at our proving ground, the new expanded program envisages utilizing the facilities of private manufacturers for accelerating research-and-development projects. To this end a number of contracts already have been placed with manufacturers for the development of certain types of ordnance equipment. Officers of the Ordnance Department and Ordnance engineers are working with the engineers of these companies to produce new types of weapons.

YOU probably have read in your newspapers concerning the development of a very large tank. This tank is being designed jointly by the Ordnance Department and a commercial company, and it is expected that in about ten months' time a tank far exceeding in power and mobility anything existing in Europe today will be completed. Another company is working on the construction of a mobile carriage for a field howitzer of great power and range. In addition to the development of weapons themselves, many manufacturers are assisting in the development of new processes to further increase production, such as the process for manufacturing bullet cores by swaging, thus eliminating the necessity for the use of screw machines; the manufacture of bomb cases by spinning tubing; the use of welded tubing for shell, and the casting of armor tank bodies.

The Ordnance Department would like to have all manufacturers take an active part in this research-and-development effort of the Ordnance Department, and a practical plan has been worked out which will make this possible. This plan envisages the formation of a number of technical advisory committees. Manufacturers of ordnance matériel will be asked to designate one or more engineers of their company to meet with qualified representatives of this Department. For example, a tank committee is being formed consisting of representatives of the tank manufacturers and representatives of the Ordnance Department. It is planned to have these committees meet about once a month. The objective of the committee will be to bring together the engineers of the Ordnance Department and of the companies manufacturing matériel for a frank discussion of engineering problems.

But the committee will have other objectives and perhaps ones of greater importance. It is desired, at these meetings, to have the engineering representatives of these companies discuss changes which should be made in the drawings and specifications of ordnance matériel in case of subsequent orders. This would involve changes which could not be made to the matériel under production. Further than that, it also is desired to use these committees to discover new ideas concerning the different types of matériel to the end that the Ordnance Department will undertake the construction of new models involving these recommendations so that improved ordnance may be available for manufacture if the war emergency should continue. Thus, every manufacturer of ordnance matériel will become a member of our engineering staff to help us secure the best possible designs. Without exception, manufacturers have come forward offering their personnel and facilities, in every case putting the needs of the defense program ahead of all other considerations.

---

*Special Assistant for Engineering, Industrial Service, Office of the Chief of Ordnance. Brigadier General, U. S. Army.

This is an address delivered at the Military Rearmament Round Table, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

Ordnance Production

Our Arms Industry Needs Trained Men and Modern Machines

By Brig. Gen. Burton O. Lewis*

IN THE national-defense appropriation bills enacted by Congress during the past summer, about two billions of dollars were included for the procurement of equipment and supplies by the Ordnance Department. The June appropriation bill carried approximately a half billion dollars, and the September appropriation bill, the remaining billion and a half. Less than ten per cent of this amount could be placed with the manufacturing arsenals of the Ordnance Department, even when expanded to their maximum capacity.

Negotiations with commercial firms were inaugurated as soon as these huge funds became available, and I am pleased to report that remarkable progress has been made to date. The expeditious contracting for these tremendous amounts in this short time was possible only because of the procurement planning conducted by the Ordnance Department during the past twenty years and because of the whole-hearted coöperation of American industry.

The Ordnance Department believes thoroughly in the decentralization of the procurement, production, and inspection functions. The Ordnance procurement districts were intended to carry on these functions in an emergency, and they now are actually performing these tasks in a most successful manner.

About the middle of July, the Ordnance district chiefs were informed of the national-defense program then under consideration by Congress. At that time they also were given a tentative apportionment of the ammunition load that their respective districts would be called upon to procure. Sometime later, in August, these tentative apportionments were brought up to date and made official. During August and early September the quotas allotted to the districts for various items of ammunition were negotiated with contractors. Satisfactory negotiated bids have now been secured on practically every item of ammunition. As a result of the energetic and highly successful manner in which these negotiations were carried on by the district offices, awards already have been made for a considerable percentage of the ammunition carried on our 1941 program.

From the appropriated funds made available during the fiscal years of 1939 and 1940, production is already under way on a number of the important Ordnance items. This includes the Garand rifle being manufactured by Springfield Armory, and light tanks, artillery, ammunition, and important fire-control equipment such as antiaircraft directors, height finders, and sound locators being made by commercial industry. As the procurement phase of the program progresses toward completion, the much more difficult problem of production must be undertaken by American industry. Speed, gentlemen, is the keynote and paramount issue of the Ordnance production problem.

There are numerous obstacles to rapid production that have long been anticipated, and they are undoubtedly in your minds. However, none of them is insuperable. Let us find out, as soon as possible, what may delay production and make our plans for overcoming these difficulties. The unfamiliarity of industry with ordnance, so little of which is produced commercially, is probably the most intangible obstacle. It will show itself in unexpected places. While the Ordnance Department stands ready to aid with its peacetime, small-scale manufacturing experience, the best means available to meet this obstacle is the energy and experience of the production engineers of American industry.

MACHINE tools undoubtedly will provide a real problem, but we are hopeful that the preparatory work done by the Ordnance Department in making surveys of the machine tools available in the plants of the country has led to the placing of orders with concerns that require a minimum quantity of new machinery. If this is so, and we will know shortly, the machine-tool problem may not be as serious as has been anticipated. Undoubtedly there will be shortages of some important tools, particularly in heavy work, but by subcontracting to those who possess the tools, or by borrowing them, or by developing alternate methods not quite so economical or so rapid, American industry will overcome these shortages and get into early production. Yankee ingenuity and driving productive force are in demand today as never before in order to produce the Ordnance requirements when needed. To meet the situation, every bit of machinery, obsolete though it may be, must be brought into use, if at all possible. Some two thousand used machine tools, largely a surplus from the last war, are in storage at the arsenals; they are now being leased or loaned to Government contractors. Though not modern, they are usable and should be put to work. As the immediate emergency is met and as new tools can be delivered, it will be possible to improve the efficiency of operation. The provision of gages and special tools requiring a high degree of trained skill in their making is also a possible cause of delay.

In the first stages of getting into production, the Ordnance Department is deeply concerned with the importance of reducing delays that later will be reflected in delayed deliveries. It is important that we have intimate knowledge of the progress being made, so that the results of any possible delays can be quickly translated into changes in the program to overcome them. The Ordnance district offices are establishing suitable organizations to follow production developments and, as soon as practicable, will administer all contracts now in force in their respective areas. The Ordnance Office in Washington is consulting with individual manufacturers on key items to keep in touch with methods of processing and the effect of delays in machine-tool deliveries.

The Ordnance Department takes this occasion to welcome its thousands of industrial partners in this concentrated drive to equip our new American armies. During the coming period of intensive struggle with the delays and interferences that hamper production, we look forward to working with you, confident in the successful attainment of our goal.

---

*Special Assistant for Production, Industrial Service, Office of the Chief of Ordnance. Brigadier General, U. S. Army.

This is an address delivered at the Military Rearmament Round Table, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

Artillery Ammunition

The Need for Quality as Well as Quantity Production

By Col. H. H. Zornig*

A COMPLETE round of artillery ammunition is a rather curious combination of organic and inorganic materials whose operation often reminds me in a general way of a Rube Goldberg cartoon. Unfortunately, I am unable to show you what I mean by drawing such a cartoon, but perhaps I can illustrate it in words:

The rookie pulls the lanyard, the firing pin sets off the primer, the primer ignites the igniter, the igniter ignites the propelling charge, the propelling charge turns into gas, the gas pushes the projectile down the bore, and so on until the projectile strikes the ground, the firing pin sets off the primer, the primer sets off the detonator, the detonator sets off the booster, the booster sets off the bursting charge, which blows the projectile all to smithereens and the fragments demolish the enemy.

I often have envied Mr. Goldberg as a designer. He has to recognize no restrictions. The practical usefulness of the effects he produces, the laws of nature, considerations of safety, or difficulties of manufacture impose no limitations on his imagination. Unfortunately, the ammunition designer always finds himself hedged in by a number of very definite restrictions.

A type or model of ammunition to be considered satisfactory must possess certain general characteristics. The most important of these are: (1) The effect produced must be tactically useful, and it must be produced with adequate intensity and satisfactory uniformity from round to round; (2) It must be safe to fire, handle, transport, and store; (3) It must be reasonably certain to function, not only when new, but also after years of storage; (4) It must be as simple in construction as practicable; (5) It must be capable of being produced by mass-production methods.

After a design which seems to embody all these characteristics has been worked out, the real difficulties begin. First, samples for test have to be made; being designed for mass production, the making of a small number is usually time consuming and very costly. Then come the tests. They ordinarily begin with the functioning tests which usually involve the firing of samples at the proving ground. Such tests in many cases destroy the samples tested, and, consequently, when they fail to function as intended, the designer has little or no physical evidence to indicate the cause of failure. Often it requires several modifications of a new design before satisfactory functioning is obtained. Then come the tests for stability in storage, safety in handling and transportation, and, in many cases, a number of other special tests peculiar to the component under development. These tests may indicate defects which necessitate a modification of the design, and then all, or at least a part, of the cycle has to be repeated. Only after satisfactory results have been achieved in such a development process can the manufacturing drawings and specifications be completed and the design released for production.

Experience has shown that this development process can, in the case of a few relatively simple and less important components, sometimes be completed in a few months. In the case of the more important or more complicated components, it may, however, extend over a number of years. That the experience of other countries in this respect is much the same as ours is shown by a conversation I had last July in Paris with a German general who had been Chief of Ordnance of the German Army when I was on duty in Berlin some years ago. It was after a good dinner, and the conversation turned to the development of ordnance matériel. The general mentioned with pride that when he was Chief of Ordnance he had been able, by exerting continual pressure, to get the development of an item with which we were both familiar completed in four years instead of the eight years which had been estimated!

OUR present standard types and models of artillery ammunition are the results of this painstaking development process. Since the World War, many significant improvements have been made. Among the most important of these are: FNH and NH powders, primers with self-contained firing pins and improved disposition of igniting charges, projectiles with improved aërodynamic characteristics, fuzes which are superior in every respect to those in use before and during the World War, and better detonator and booster explosives.

Although we are still a long way from the ideal in any case and must continue to prosecute our development work vigorously, I believe I am safe in saying that, in so far as design is concerned, our present standard types and models of artillery ammunition are equal to or better than those possessed by any other army in the world.

This summer, I came across a "Handbuch der Luftfahrttechnik" which described the aircraft accessories and armament made by various German manufacturers. In the section devoted to bombs, I found the following statement: "The strength of the bomb cases is greater than that required by the specifications for U.S.A. demolition bombs."

Evidently the bombs that have been designed and developed by the same organization that has developed our artillery ammunition serve as a standard of comparison even in a country that has always been noted all over the world for the excellence of its ordnance matériel.

The satisfactoriness of the artillery ammunition that is issued to the troops is dependent not only upon the excellence of the design but also on the quality of the material, the processes, and the workmanship used in its manufacture. This consideration brings up the problem of determining the quality of the manufactured product.

One naturally thinks first of the method suggested by the old adage, "The proof of the pudding is the eating." This is undoubtedly an excellent method for testing the quality of the pudding, but "you cannot eat your pudding and have it too." The way out of this difficulty that naturally suggests itself is to test it by eating only one spoonful. Having applied this test, what assurance have we that the rest of the pudding

*Aberdeen Proving Ground, Md. Colonel, Ordnance Department, U. S. Army.

This is an address delivered at the Technical and Engineering Session, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

will taste like the spoonful we have eaten? To assure ourselves of this, we may eat several spoonfuls. This may give us additional confidence in our knowledge of the quality of the uneaten portion but we still cannot be absolutely sure of it. A little consideration will indicate that the best way of making reasonably certain that our pudding will be good involves several steps: First, we must make sure of the quality of the materials we use; next, we must select a good recipe, and, thirdly, we must follow it meticulously. Having done this, we can feel reasonably sure that our pudding is good and the eating of a single spoonful will serve to assure us of this.

NOW let us see how this general line of thought applies to the manufacture of artillery ammunition. Functioning and other tests undoubtedly can be devised which, when applied to a completed component or round, will indicate whether or not it will behave in accordance with the design. However, it is a peculiarity inherent in ammunition that a component or round is destroyed by such a test. Consequently, if any ammunition is to be left over after the tests are completed, such tests can be applied only to samples selected to represent the remainder of the manufactured product. However, right at this point, in the selection of the samples, the element of chance enters to render the results uncertain. Let me cite a simple example to make the point clear.

Let us assume that we have a large number of lots of a component and that of the components in each lot, eighty per cent will function perfectly and twenty per cent are defective. Now let us select a sample of ten from each lot. It can be shown mathematically, with no uncertainty, that due to chance in the random selection of the samples, in the long run 32 per cent of the samples will contain more than 2 defectives; 68 per cent of the samples will contain not more than 2 defectives; 37½ per cent of the samples will contain not more than 1 defective, and 11 per cent of the samples will contain no defectives. Now suppose we have a specification which requires all lots whose sample contains more than one defective to be rejected (thereby giving the impression that any lots containing more than 10 per cent defectives are considered unsatisfactory), then in the long run, 37½ per cent of the lots will be accepted. If we look back, we will see that we assumed in the first place that all the lots under consideration contained 20 per cent defectives, so that all the lots we have accepted must also contain 20 per cent defectives in spite of all our testing. The net result is that all we have accomplished is to reject 62½ per cent of the unsatisfactory lots and accepted the rest.

Now suppose that we tighten up on the specification so that no defectives are permitted in a sample of ten. Then we will in the long run accept only 11 per cent of the lots with the result that the manufacturer loses more money and the Army gets less ammunition, but that which it does get, still as before, contains 20 per cent defectives.

Let us now assume that we have before us a number of lots of components and that of the components in each lot 95 per cent will function perfectly and only 5 per cent are defective, and again let a sample of 10 be selected from each lot. In this case, it again can be shown mathematically, with no uncertainty, that due to chance in the random selection of the samples, in the long run nearly 9 per cent of the samples will contain more than 1 defective. Under a specification which permits 1 defective in a sample of 10, 9 per cent of these lots will be rejected although the specifications apparently indicate that lots which contain up to 10 per cent defectives are to be considered satisfactory.

THESE few examples indicate quite clearly that this method of distinguishing between satisfactory and unsatisfactory ammunition does not discriminate closely enough. To be sure, the discrimination can be improved by increasing the size of the sample, but to get a closeness of discrimination which can be deemed satisfactory, the sample size becomes prohibitively large, especially in the case of components which are costly to make or where the cost of conducting the tests is high.

This whole matter can be summed up very simply. By this method, one accepts just the product which is presented. The lower its quality, the greater will be the proportion rejected and no matter how high its quality, so long as it is short of absolute perfection, some of it will be rejected.

This statement, however, also indicates a way out of the dilemma. Since only satisfactory ammunition is wanted, all that has to be done is to see to it that only satisfactory ammunition is presented for acceptance. Then if the results of the tests of the samples are properly interpreted, practically none of this need be rejected.

But what can be done to insure that only ammunition of satisfactory quality will be presented for acceptance? The answer to this is that the manufacturer must see to it that his plant produces only ammunition of satisfactory quality. The steps he must take to insure this are essentially those that were found necessary to produce a good pudding: He must see to it that the raw materials used are suitable in kind and quality; he must develop and rigidly follow a process or manufacturing practice which will produce a satisfactory product, and he must institute a system of inspections and tests and methods of interpreting their results which will tell him when and where this process or manufacturing practice is being departed from. The final functioning tests should form a part of this system.

The kinds and grades of raw materials required are in most cases indicated in the drawings and specifications. Processes and manufacturing practices which will produce a satisfactory product have been developed for most artillery ammunition items by the arsenals or private manufacturers in the course of their work under educational or smaller production orders. In recent years, many improvements have been made in methods for securing so called "quality control," and these are available to anyone who cares to make use of them.

With these conditions existing at this time when mass production of our new types and models is getting under way, I have every confidence that the artillery ammunition that will be available to our troops will be equal to or better than the corresponding type that will be available to any enemy they may be required to face.

EDITOR'S NOTE.—Apropos of Colonel Zornig's references to methods for distinguishing between satisfactory and unsatisfactory ammunition, ARMY ORDNANCE will publish in its next issue an informative article entitled "Statistical Methods and Quality," by Capt. Leslie E. Simon, executive officer of the Ballistics Research Laboratory at the Aberdeen Proving Ground, Md. Captain Simon writes of the contribution of statistical methods to the development of specifications and describes a system for the surveillance of ammunition.

Ordnance Facilities

Contracting for the New Armament Plants

By Brig. Gen. L. H. Campbell, Jr.*

THE Facilities Division of the Industrial Service came into being in June 1940. It was organized for the purpose of negotiating contracts for the creation of new plants and for adding manufacturing facilities to existing plants. Very often it has been necessary, as for instance in the case of powder and TNT plants, to erect entirely new layouts. In other cases, as in the manufacture of machine guns, existing buildings have been used wherever possible. Obviously it is our desire to do as little construction work as necessary so that the sum total of funds may be used for manufacture of Ordnance items rather than for the mere construction of buildings.

Many considerations influence the selection of sites and the determination as to whether new buildings are necessary or whether existing ones can be used. One of these considerations, for instance, is the fact that under the direction of the General Staff we are trying to keep all our manufacturing plants as far in from our borders as is practicable; but other factors have due weight.

Let us take the case of a powder plant. One of the first considerations is that water in sufficient quantity and quality be available. Ample acreage must be at hand, as it is necessary to spread the units of the plant as far apart as is reasonably practicable from the manufacturing standpoint. Sufficient labor must be available within the community so that additional houses do not have to be erected and later be abandoned were the plant to be closed. It is also desired, if possible, to avoid the necessity of mass migrations of workers. Railroad and highway transportation must be adequate. The land must, for best uses, be fairly level so as to avoid the necessity of expensive grading. Trees are very helpful, not only from the standpoint of beauty, but also as a hindrance to ready detection from the air. They also serve as barriers against explosions and detonations.

The form of contracts into which we have entered are in the main the fixed-fee type. That is to say the Government defrays all costs involved and gives to the contractor a fixed fee based upon the estimated cost of the project. In some cases the cost-plus-a-fee provision is also used within the same contract covering the operation of the plant built under the contract. In other cases the plant is built under a cost-plus-a-fee provision and operations are conducted for a lump sum, or in some cases an upset price figure. The law under which we first operated limited the fee to seven per cent of the estimated cost of the work. The last Army appropriation act reduced this fee to six per cent.

Another type of contract we are using embodies the form known as the emergency plant facilities contract which provides that a plant is built at the contractor's expense and later purchased from the contractor in five equal annual installments. At the end of the five years, the contractor has the option to buy the plant at a negotiated price should its use by the Government be no longer necessary. This, in effect, really amortizes the plant within five years for tax purposes.

UNFORTUNATELY, as much as we would like to, it has been found quite impossible to use a standard form of contract as each individual case differs from all others. For instance, in some cases we may have to make provision to lease or buy ground; in other cases this is not necessary. We have encountered conditions where we have had to build short power lines into our plants; in some we have had to use the cost-plus-a-fee basis for the plant to be built on property which we have purchased and the 5-year amortization type of contract used for such work as the contractor must do on his own property. Every situation has its own peculiar features. Therefore each contract is an entity within itself.

In passing, it is a very real pleasure to be able to say that without exception the contractors with whom we have dealt have evidenced no attitude other than one of service to their country. The profit motive has not been apparent. The spirit of willingness and coöperation has been one of the most pleasant features of our work. The attorneys of many contractors have worked with our lawyers of the Judge Advocate General's Department and others whom we have acquired; the attitude of these gentlemen has been indeed an inspiration. Were I to mention the names of the people within the Facilities Division who have made our work possible, I would have to call the roll of all the men and women comprising it. They all have worked without regard to hours, and their devotion to duty has been most exemplary.

EDITOR'S NOTE.—As of December 5, 1940, twenty-two new major facilities of the Ordnance Department are under way for Ordnance production by private manufacturers. They are (with sums allotted for plant and production): Indiana Ordnance Works, Charlestown, Ind., smokeless powder, $51,000,000; Ravenna Ordnance Plant, Ravenna, Ohio, shell loading, $14,215,000; Kankakee Ordnance Works, Wilmington, Ill., TNT, DNT, and tetryl, $28,623,000; Elwood Ordnance Plant, Wilmington, Ill., shell loading, $14,000,000; Radford Ordnance Works, Radford, Va., smokeless powder, $39,800,000; Utica Machine Gun Plant, Utica, N. Y., $17,600,000; Detroit Ordnance Plant, Detroit, Mich., tanks, $53,500,000; Machine Gun Plant, Hartford, Conn., $4,000,000; 37-mm. Gun Plant, Hartford, Conn., $4,000,000; Armor Plate Plant, Philadelphia, Pa., armor plate, $1,018,400; Machine Gun Plants at Flint, Mich., Dayton, Ohio, Saginaw, Mich., and Syracuse, N. Y., machine guns, $20,000,000; Gadsden Ordnance Plant, Gadsden, Ala., forging and machining shell, $23,500,000; Iowa Ordnance Plant, Burlington, Iowa, shell loading, $34,000,000; Lake City Ordnance Plant, Lake City, Mo., small-arms ammunition, $71,600,000; Weldon Springs Explosives Plant, Weldon Springs, Mo., TNT and DNT, $6,390,000; Baytown Ordnance Works, Baytown, Tex., toluol, $11,857,000; Homestead Gun Plant, Homestead, Pa., cannon, $8,070,000; Kingsbury Ordnance Plant, Kingsbury, Ind., shell loading, $26,800,000.

---

*Special Assistant for Plant Facilities, Industrial Service, Office of the Chief of Ordnance. Brigadier General, U. S. Army.

This is an address delivered at the Military Rearmament Round Table, Twenty-first Annual Meeting, Army Ordnance Association, October 8, 1940, the Waldorf-Astoria, New York, N. Y.

Brig. Gen. E. M. Shinkle
Picatinny Arsenal

Brig. Gen. A. G. Gillespie
Watervliet Arsenal

Brig. Gen. G. H. Stewart
Springfield Armory

The Arsenal Commanders

Increased Responsibilities Bring General Officer Rank

THE six manufacturing arsenals of the Ordnance Department of the Army are unique institutions—unique because of the vitally important rôle they fill in the national-defense scheme of our country. They are the repositories of knowledge for the design, development, production, and maintenance of our military equipment. In time of peace as well as in war, they are the focal points from which radiate the method and the technique of arms production. Today, operating on a 3-shift basis, they are producing ordnance equipment to the limit of their capacity. In recognition of this fact, and for the first time in the history of our country, the commanding officers of these establishments were promoted to the rank of brigadier general.

In announcing these promotions on October 25, 1940, the War Department emphasized that present expansion will increase the Army's active strength from 227,000 to 1,400,000 men in one year. This expansion cannot be carried out without proper leadership—promotions to temporary ranks are essential to meet the requirements.

The commanders of the six Ordnance manufacturing arsenals, who have been raised from the rank of colonel to that of brigadier general are: Brig. Gens. Edward M. Shinkle, Picatinny Arsenal; Gilbert H. Stewart, Springfield Armory; Rolland W. Case, Watertown Arsenal; Norman F. Ramsey, Rock Island Arsenal; Alexander G. Gillespie, Watervliet Arsenal; and Walter P. Boatwright, Frankford Arsenal. All these officers have distinguished military careers.

BRIG. GEN. EDWARD M. SHINKLE, a native of Ohio, began his Army service as a cadet at the United States Military Academy in June 1897, graduating in the class of 1901. His first service with the Ordnance Department was as a 1st lieutenant at the Sandy Hook Proving Ground. During the World War he served as Chief of the Artillery Ammunition Division in the Office of the Chief of Ordnance at Washington, until June 1918, when he was ordered to duty with the American Expeditionary Forces.

Upon his return to the United States he was on duty with the Engineering Bureau and the Artillery Ammunition Section of the Ammunition Division. After graduation from the Army War College he was in command of the Picatinny Arsenal until January 1921. Subsequently he served as a member of the General Staff and later was Ordnance officer of the Ninth Corps Area. Following a tour as executive officer to Maj. Gen. C. C. Williams, Chief of Ordnance, General Shinkle was appointed commanding officer of the Aberdeen Proving Ground. During his command, the Proving Ground began a memorable program of rehabilitation. On September 1, 1934, General Shinkle assumed his duties as an assistant to the Chief of Ordnance with the rank of brigadier general in charge of the Field Service of the Ordnance Department. Upon completion of that duty in 1938 he was again ordered to command the Picatinny Arsenal.

BRIG. GEN. GILBERT H. STEWART was graduated from the Military Academy in 1902 and detailed to the Ordnance Department in 1904 where he was on duty at the Sandy Hook Proving Ground. Throughout his entire military career General Stewart has been in close touch with ordnance production, most of his service having been either at or in connection with the manufacturing arsenals.

From 1914 to 1918 he was works manager at the Springfield Armory, which establishment he now commands. During the World War he was in the Production Division of the

BRIG. GEN. W. P. BOATWRIGHT
FRANKFORD ARSENAL

BRIG. GEN. N. F. RAMSEY
ROCK ISLAND ARSENAL

BRIG. GEN. R. W. CASE
WATERTOWN ARSENAL

Ordnance Department and subsequently served on the Ordnance Claims Board in which assignment he was engaged as a direct representative of the Secretary of War in conjunction with the Imperial Munitions Board of Canada in settling claims of Canadian contractors. He was chairman of the board in 1921. He was graduated from the Army War College in 1922 and from the Army Industrial College in 1932. The following six years were spent in command of the Watervliet Arsenal, and since September 12, 1938, he has been in command at Springfield.

BRIG. GEN. ROLLAND W. CASE was appointed to the Military Academy from Michigan and was graduated a member of the class of 1905. He also was graduated from the Ordnance School of Technology, 1913, the Coast Artillery School, 1922, the Command and General Staff School—where he was a distinguished graduate—1923, and the Army War College, 1929. General Case twice served as a member of the General Staff Corps—from 1924 to 1928 and from 1932 to 1936. He has been in command of the Watertown Arsenal since August 11, 1937.

BRIG. GEN. NORMAN F. RAMSEY had his first military service as a private and corporal, Company E, 20th Kansas Volunteer Infantry 1898-1899. He was graduated from the U. S. Military Academy, a member of the class of 1905. He was stationed at various arsenals and in the Office of the Chief of Ordnance until 1916 when, as a major, he became assistant officer and officer in charge of manufacturing operations, chief engineer and chief inspector at Rock Island. During the World War and until 1920 he was Assistant to the Chief Ordnance Officer of the A.E.F. at Tours, France, and Chief Ordnance Officer, American Forces in France.

Following his graduation from the Army War College in 1921 and service in the Office of the Assistant Secretary of War, he became commanding officer of the Picatinny Arsenal and subsequently student and instructor at the Command and General Staff School, Fort Leavenworth. Previous to assuming command at Rock Island in 1937 he was for two years Ordnance officer of the Second Corps Area at Governors Island, N. Y., and Chief of the Ammunition Division and the Artillery Division in the Office of the Chief of Ordnance. While in command of the Picatinny Arsenal in 1926, General Ramsey was awarded the Soldier's Medal for Heroism, for bravery at the explosions at the Lake Denmark Naval Ammunition Depot, July 11, 1926.

BRIG. GEN. ALEXANDER G. GILLESPIE began his military career as a graduate of the United States Military Academy, a member of the class of 1906. He is also a graduate of the Coast Artillery School, the Command and General Staff School, and the Army War College.

He served in France as division Ordnance officer of the 86th Division and was on duty in the Ordnance repair shops at Mehun, France. Subsequently he was Assistant Military Attaché at Tokyo, Japan; Ordnance officer of the Sixth Corps Area, and professor of ordnance and the science of gunnery at West Point. He was in command of the Rock Island Arsenal from 1934 to 1937 and chief of the Artillery Division of the Industrial Service, Office of the Chief of Ordnance, from 1937 to 1940.

BRIG. GEN. WALTER P. BOATWRIGHT was graduated from Virginia Polytechnic Institute in 1907. The following year he was appointed a 2nd lieutenant, Coast Artillery Corps. He served in France from October 1917 to March 1919 as adjutant, Base Section No. 2 at Bordeaux, 30th Artillery Brigade; on staff of the Chief of Artillery, 1st Army, and of the Chief of Artillery, A.E.F. He was also a member of the Caliber Board. He participated in the battles of Aisne-Marne, Oise-Aisne, Meuse-Argonne. Following the World War he was on duty at several arsenals. His present tour of duty at Frankford Arsenal was begun in August 1938 He assumed command of the arsenal December 1, 1939.

ARMY ORDNANCE

Founded 1920

Published Bimonthly by
THE ARMY ORDNANCE ASSOCIATION
WASHINGTON, D. C.

Managing Editor: Lieut. Col. L. A. Codd, Ord. Res.
Associate Editor: R. E. Lewis, Jr.
Editorial Staff: Lieut. Col. C. H. Goddard, Ord. Res.,
F. G. Ferriter, H. E. Allen, F. W. F. Gleason.

JANUARY-FEBRUARY, 1941

Month by Month

REVISIONS UPWARD OF THE ENTIRE NATIONAL defense program have been so frequent and so kaleidoscopic as to confuse even those who are closest to it. Emphasis on one phase frequently obliterates another phase and sometimes obscures the final objective. But the target must be kept in range. What are we shooting at?

In dollars and cents our current expenditures for the national defense are greater than they have ever been in our peace-time history. These sums have been appropriated: for the Army, $8,792,145,145; for the Navy, $5,537,138,137. In both cases these are direct appropriations. In addition, appropriations for civil activities contributing to national defense services and enforcement of neutrality amount to $776,944,648. The grand total is $13,106,227,930. The naval shipbuilding expansion program, providing long-range commitments in excess of present appropriations, has an additional estimated cost of $4,586,000,000; so that total commitments for national defense and neutrality enforcement reach the staggering sum of more than $17,000,000,000! So much for the cost in dollars and cents.

Translating money into people and things, the target assumes colossal proportions.

As to personnel, we intend to—

Raise enlisted strength of Regular Army from 227,000 to 375,000. (Those numbers include the Philippine Scouts.)

Raise the strength of National Guard (officers and men) from 210,000 to 346,130, and employ it on active service.

Induct and train a minimum of 695,990 selective trainees.

Increase Army Reserve officers on extended active duty from 3,555 to 55,592.

Raise enlisted strength of the Navy from 145,000 to 170,000, including 10,000 Naval Reservists to volunteer for active duty.

Increase Naval Reserve officers on extended active duty from 853 to 3,269, plus 5,000 Reserve midshipmen.

Increase Naval Reserve men on extended active duty from 436 to 628, plus 5,351 additional reservists in training as student pilots.

Raise the enlisted strength of Marine Corps from 25,000 to 34,000.

Increase Marine Corps Reserve officers on extended active duty from 214 to 252.

House, clothe, subsist, pay, and train these expanded forces, including augmented training for forces in existence prior to expansion.

Increase pilot training and develop enlisted airplane mechanics.

As to matériel, we intend to—

Provide for completely equipping with essential items (items not normally produced commercially) the Protective Mobilization Plan force (1,400,000 men) and to maintain that force on a combat status.

Provide all reserve stocks of the critical items of supplies (semiautomatic rifles, antitank guns, tanks, light and heavy artillery, ammunition, gas masks, etc.) needed to equip a ground force of 2,000,000 men.

Provide the Army with a force of 25,000 and the Navy with a force of 10,000 serviceable airplanes.

Begin the construction of 292 combatant naval vessels and 57 auxiliary ships for the 2-ocean Navy.

Recondition decommissioned naval vessels and acquire and convert auxiliary ships.

Provide additional production facilities, including new plants and extension of existing plants for accelerating immediate programs and to supply potential, continued, and augmented demands.

Establish and develop new Army and Navy air bases and stations.

Provide for many and varied collateral expenses in connection with all the foregoing, including facilities and storage.

IT IS APPARENT FROM THIS MERE STATEMENT of our preparedness objectives that the morale factor as well as the material factor requires emphasis. So vast a project can be successfully completed only by the very best kind of teamwork on the part of every one concerned. And the entire population of the United States is concerned with the new concepts of total war and what that term means all down the line.

From the many articles published in this issue of ARMY ORDNANCE it is obvious that the leading officials of our defense effort are conscious of the need for teamwork. Every one of them insists that teamwork—and teamwork alone—will win the day. This means, of course, that no obstruction or obstructionist tactics can be allowed anywhere. Management must carry its share of the burden in the very same spirit as our new universal-service soldiers—without a whimper, without selfishness, without undue profit and without delay. Likewise Labor must do its share manfully. That means it must forego some of the easier things that have become incidents of normal times and undertake some of the harder things that come in time of trouble. Those factions of Labor which already have delayed parts of the defense program by unreasonable and at times treasonable conduct will rue the day. If we are going to produce the

defense things we need, as the Army and Navy need them, there can be but one purpose in mind and but one road to follow. That road has "teamwork" on all its signposts.

For whatever changes have come about in modern war only the superficial facts are new—the old principles still remain. They remain as well in the factory as they do on the field of battle. They have not been outmoded on the field of battle; neither will they be in the factory. That they are not superseded tactically we cite the testimony of a German General Staff officer who is credited with this summary of his army's recent success: "Our success is due to close teamwork between the air force, armored troops, motorized engineers and infantry. Of course the infantry must finally hold the ground, but all others help to bring it up. Our methods are simple in the extreme; they are understood by every soldier in the army. Our foot infantry is the best in the world. Their principal job is marching, *and the job of every other arm* is to keep them marching forward into enemy land. We move on a broad front with armored divisions and air force. Where the initial resistance is too strong for the armored troops to penetrate, it is broken by dive bombers and additional artillery. The way must be cleared for the infantry with whom the final decision lies. This requires perfect communication and coördination between arms; further, it requires a singleness of command and purpose."

As General Marshall, our Chief of Staff, commented, this officer "is describing a highly organized team, a balanced team, in contrast to a few highly developed specialties each operating somewhat according to its own theory of combat."

If we in America are as sensible as we usually claim to be we will make certain that teamwork will be the measure of our success. And *nothing* can be allowed to stand in its way!

THE BROAD FRONT ON WHICH THIS DOCTRINE applies is indicated by the filtration of defense orders down through all echelons of industry. Not only are the big quantity producers of peace-time products our sure reliance in time of emergency but the vast aggregation of subcontractors comes into the picture in constantly increasing numbers. To think of our national-defense effort only in terms of the "big fellows" is to miss the more important element.

Hence it is with considerable pleasure one can view recent steps of the National Defense Advisory Commission in turning its attention to business as a whole, every resource of which must play its part. Donald M. Nelson, recently appointed coördinator of purchases for the Commission, emphasized this vital point in a recent address. "Back of every assembly line," he said, "that turns out tanks, bombers, pursuit planes, heavy guns, there is an army of subcontractors, supplying material and parts. For example, in the assembly of a Pratt & Whitney airplane motor, 40 per cent of the parts are supplied by subcontractors. For the average bomber turned out by the Glenn L. Martin Company, the services of several hundred subcontractors are required—subcontractors located in every part of the country and whose products come from virtually every State in the Union. The Douglas Aircraft Company recently awarded $75,000,000 worth of subcontracts at one time.

"The great majority of these subcontractors have been trained to work in groups around certain primary contractors. The armed services for many years have been engaged in surveying and lining up subcontractors so they might fit into the defense program. We have, therefore, at the present time, groups of skilled subcontractors revolving about certain major prime contractors. This practice might be described as the 'subcontractor solar system'—each subcontractor being a satellite in the orbit of some major contractor. . . .

"Therefore we must turn our attention to this army of subcontractors and suppliers—the men and enterprises behind the assembly lines. We must make sure that we tap all existing subcontracting facilities and that they have access to capital and credit to enable them to participate in the national-defense program, for it is of the utmost importance that there be no breakdown in the steady flow of parts and supplies to the assembly lines. We must not repeat the mistakes made by France and Britain in not paying sufficient attention to the smaller fellows down the line."

THE NATIONAL RIFLE ASSOCIATION IS DOING A distinct service to the country in exposing the apparently well-engineered drive now under way to disarm civilian America. The new campaign for individual disarmament is being waged differently from the old campaigns for the same purpose. Now the attack is being made through local agencies (city councils, police officials and law-enforcement agencies). Quite disgraceful is the claim by these individual disarmament advocates that the thing is being done in the name of "national defense".

The *American Rifleman,* journal of the N.R.A., comments: "At first glance it would appear that with such a variety of law-enforcement groups supporting similar measures, there must be 'something to' the idea. There is. But the 'something' is not concerned with the national defense! It is as narrow-minded and disgraceful an attempt by a small group of stubborn individuals to foist their ideas upon the American people as any incident in our political history. It is narrow-minded because it refuses to accept the opinions of impartial individuals and groups, including Congressional committees, which have exhaustively studied the problem. It is disgraceful because it attempts to gain its end by capitalizing on the patriotism of American citizens and their officials in the face of living evidence in England that general firearms regulation and control is a serious handicap to national defense and an invitation to looters and other criminals during a national emergency."

ARMY ORDNANCE adds its voice in support of its distinguished contemporary. The clumsiest sleight-of-hand trick, apparent in the last row of the gallery, is to try to deny that nearly every nation which has succumbed to conquest in the past year has had some crazy idea about the right to make arms or of the individual citizen to bear arms. Check the list and you will find that the conqueror's road is made easy when the people to be conquered do not have the arms with which to protect themselves or, if they do have the weapons, do not know how to use them. If there was ever a time in the history of the world when the American people should become a nation of riflemen and target shooters (and preferably shooters at *moving* targets) it is now. In this day when every good citizen wants to help the national defense he can do no finer thing than help *in his own locality* to scotch the doctrinaires who would disarm us individually to our peril. Instead of limiting the right to bear arms at this stage of events we should be urging the proper use of that right. It is the best kind of true national defense at all times.

Shadow Factories

An Editorial

OF our current $2,000,000,000 defense construction program, $520,000,000 is for the construction of productive facilities: airplane and engine plants; armor, tank, ammunition and loading plants; shipways and shipyard facilities. Of these, the plants which will produce noncommercial articles, that is to say, the ordnance plants, are shadow factories. This is the name coined in England five years ago when England undertook her rearmament program. A shadow factory is a plant which will be kept in stand-by condition after a present need has been met. Even though our shadow factories are only now building, it is not too early to stress their importance for the distant as well as the immediate future.

On two other pages in this issue of ARMY ORDNANCE are listed (1) the probable number of additional plants required for our complete military rearmament (p. 344); (2) the ordnance plants under construction early in December (p. 369). The immediate job is clear. These plants must be built as quickly as possible and put into operation without delay. They must continue to operate until the present need for their products is fully met. But once that need is met what is to become of them thereafter? This time there can be but one answer. They must become shadow factories; that is to say, they must be kept in A-1 stand-by condition for many, many years to come. They will have to be rehabilitated from time to time; frequently they will have to be operated for trial runs by their private civilian operators.

The foolhardiness of our national policy regarding ordnance production capacity following the World War is now perfectly apparent. On November 12, 1919, the Ordnance Department of the Army found itself in possession of nearly one hundred plants of various types which had been constructed for the production of ordnance equipment. Many of these plants were for the manufacture of chemicals, powder and explosives, for ammunition loading, for components, for guns, for armor. But the American people were convinced that the war to end war had been fought and won! So our priceless production capacity was scrapped, and some of it ruthlessly scrapped. Sound military advice was disregarded and cheap political badinage was gospel. The result of that folly is now being brought home in our frantic efforts to rebuild substitutes for many of those scrapped facilities.

BASED on this sad experience, our national policy regarding the future of our shadow factories is clear. It should be, first, that they must remain shadow factories indefinitely; secondly, they must be operated by private industry always. It should not be necessary to argue much on either point. The facts of the case are argument enough.

If our World War plants were in readiness today, our armament production would be advanced anywhere from six to eighteen months. The same ratio of production gain will apply to any future emergency from now until doomsday. Ordnance production capacity is always the great need in time of trouble. Now we are building that capacity up to the point where it will be adequate to supply noncommercial ordnance items to an army of 2,000,000 men. A nation such as the United States cannot afford to scrap that production capacity over and over again. This time these plants ought to remain in stand-by for years to come and, most important, plant and equipment should be rehabilitated and renovated periodically. Shadow factories, after all, are not essential because they are so much brick and mortar. Their greatest value lies first in the equipment they have on hand for their production job and, secondly, in the "know how" on the part of the plant management. The cost of machinery replacement in our shadow factories should be a regular part of the cost of national defense. Our overage battleships are discarded and replaced. Hereafter, so should it be with the equipment of our shadow factories.

THE second point in connection with our shadow plants is that they always must be operated by private industry—in peace and in war. They are being built and operated by private industry now. They must never become an opening wedge for nationalization of the arms industry in the United States. That crazy battle was fought out in the United States some six years ago. It was proved to be fallacious, extravagant, and—worst of all—socialistic. Since the collapse of Nyeitis, even greater arguments against nationalization of the arms industry have been written into the record. One cannot escape the conclusion that a great contributing factor to the downfall of France was the nationalization of her arms industry. Nationalization is the Communist's first point of attack. He knows only too well that there is no more vital place where he can attack the stability and safety of any country than in her churches and in her armed forces. When unable to break the morale of either, he turns to the arms factories and by means of the slow-down, the sit-down, nationalization, and kindred types of racketeering, breaks the very bone and sinew of a nation's defense. *It must not be so with us!*

Therefore, let every friend of Ordnance in the United States begin now to give serious thought to our new ordnance production capacity. Let him help put his neighbor straight on what these plants are for, what they mean, and why they must be kept in a constant state of readiness. Once they are built and in operation their cost can be translated directly into military protection. When they have fulfilled their present mission, their stand-by cost can be translated into months and even years saved in any future emergency. And private industry, having operated these plants in the present emergency, remains for their future operation the backbone of our national defense. The emergency over, industry should be called upon to operate the shadow factories from time to time, to test the production technique and to familiarize new personnel with the problems of quantity manufacture. Such occasional operation could be handled on the same management-fee basis as now applies to the construction and operation of the plants themselves. And thereafter the matter of new equipment ought to be taken care of with the regularity —but not the frequency or commotion—of a senatorial election. England began her shadow-factory program in 1936, but then lost heart and paid only lip service to it. If we follow suit now, or at any time in the future, we may find ourselves in the same plight. Our shadow factories, in the course of the months ahead, will become substantial; when their present job is done let us see to it that they will remain substantial shadows, ever lengthening in the cause of peace. L. A. C.

Association Affairs

CLEVELAND POST INAUGURAL

WITH nearly seven hundred representatives of industry of Cleveland and Northern Ohio in attendance, the Cleveland Post, Army Ordnance Association received its charter at a dinner meeting held at the Hotel Cleveland, Friday, October 25, 1940. Maj. Gen. C. M. Wesson, Chief of Ordnance of the Army, was the honor guest and principal speaker. Brig. Gen. Benedict Crowell, president of the Army Ordnance Association, conferred the charter. Frederick C. Crawford, a director of the new chapter, was toastmaster. Never before in the history of the sixteen Ordnance districts has there been so large and so enthusiastic an inaugural meeting. General arrangements were directed by Maj. H. M. Reedall, executive officer of the Cleveland Ordnance District. The American Society for Metals participated in the meeting.

General Wesson spoke on "Progress in Rearmament." With particular reference to Cleveland's place in our national defense and the rôle which certain of its citizens have filled for many years, General Wesson said:

"This great gathering of American citizens representing industry and engineering in this defense-minded Cleveland area is most inspiring. It brings to a culmination what has been for me a most enjoyable and instructive day. I have had an opportunity to visit some of your larger manufacturing plants and to enjoy the hospitality at luncheon of some of your business and civic leaders. On all sides I have been impressed, not only by your proverbial hospitality but equally by the atmosphere of coöperation with the fighting forces of our nation—an attitude which is evident on all sides.

"The experiences of the day have thus enkindled a feeling on my part of very deep gratitude and, at the start, I wish to express that feeling as best I can to one and all. It is a heartening thing for one in my position, responsible under the law for the adequacy in quantity and quality of the fighting equipment with which the American soldier must defend himself—it is heartening I say, to foregather here with men who represent so large a section of the power and strength of American industry. It is no mistaken belief on my part or on the part of any other observer that what I have seen today and your presence here tonight are indicative of success in anything America undertakes in peace or in war.

"It is an especially happy occasion for me to be present at the inaugural of a new chapter of our nation-wide Ordnance society. As a charter member of the Army Ordnance Association and as Chief of Ordnance of the Army of the United States, I welcome the new chapter as another base in a strong and growing line of our industrial-preparedness fortifications.

"The Army Ordnance Association has grown in numbers and in influence through the years. Its latest acquisition—a local Post in the great city of Cleveland—connotes, not only virility of purpose, but certainty of objective. Any national society which, after twenty-one years of active work for the national defense of the United States, is not lost in the defeatist attitude that there are no other domestic frontiers to conquer, is worthy of praise. Your Association having proved the soundness of its philosophy since 1919 is, now in its twenty-first year, assuming greater obligations and at the same time time producing greater results. Permit me to congratulate you all upon this achievement.

"Permit me also, if you please, to speak in a personal vein. When I accepted the invitation to visit with you this evening, I did so, not only for the pleasure it would afford to address you on the status of our military rearmament, but also because it offered an opportunity I have long sought to pay honor to one of your great citizens, my very dear friend, General Crowell. I have worked with him for twenty-one years in trying to further the cause of industrial preparedness. We in the War Department at Washington know him as a great citizen. Tonight I am afforded one of the most pleasant opportunities of my entire tenure as Chief of Ordnance of the Army of the United States in felicitating him as president of our society. The annals of our national defense are replete with examples of men whose energy, loyalty, zeal and sound judgment have been given without stint in time of emergency. To that long list belongs the name of General Crowell.

"We of the Ordnance Department served closely with him when, as Director of Munitions in the World War, he directed the Army's armament effort with such distinction. We stood by with silent applause when, the war being over, he did not leave the colors but saw to it that industrial preparedness as a basic philosophy of our national defense was written into the organic law of the land in the National Defense Act of 1920. We have admired the constancy and devotion he has given to the Ordnance cause uninterruptedly as president of the Army Ordnance Association since 1919. We of the Army have observed with approbation how his counsel and advice in things military have been sought year in and year out by leaders of the nation without regard to party. We were particularly happy when General Crowell, several months ago, was called to duty in the War Department as a special personal consultant to the Secretary of War. I add my felicitations to yours in congratulating and thanking General Crowell for all that he has done so unselfishly for so many years and for all that he is doing now in the same fine spirit.

"I hope that the people of Cleveland will never lose sight of Cleveland's contribution to our national defense. I refer not only to your industries and your man power and your coöperation. There is something deeper than these—it is a philosophy of national defense itself. You have in Cleveland another civilian leader whose military leadership in the modern sense is very great. He too is a member of what we in the Army know as the 'Cleveland triumvirate.' He was one of the three Clevelanders—General Crowell and the great Secretary Baker being the other two—who gave America an understanding of modern national defense. He is Col. Frank Scott, known and beloved by the Army of today as he was to the Army of 1917 and 1918. Colonel Scott's contribution to modern thought regarding our national defense is very great. What he did in the initial organization of the General Munitions Board in 1917 and subsequently the War Industries Board as its first chairman is producing results today so satisfactorily that today's industrial-preparedness problems are spared many of the difficulties of two decades ago.

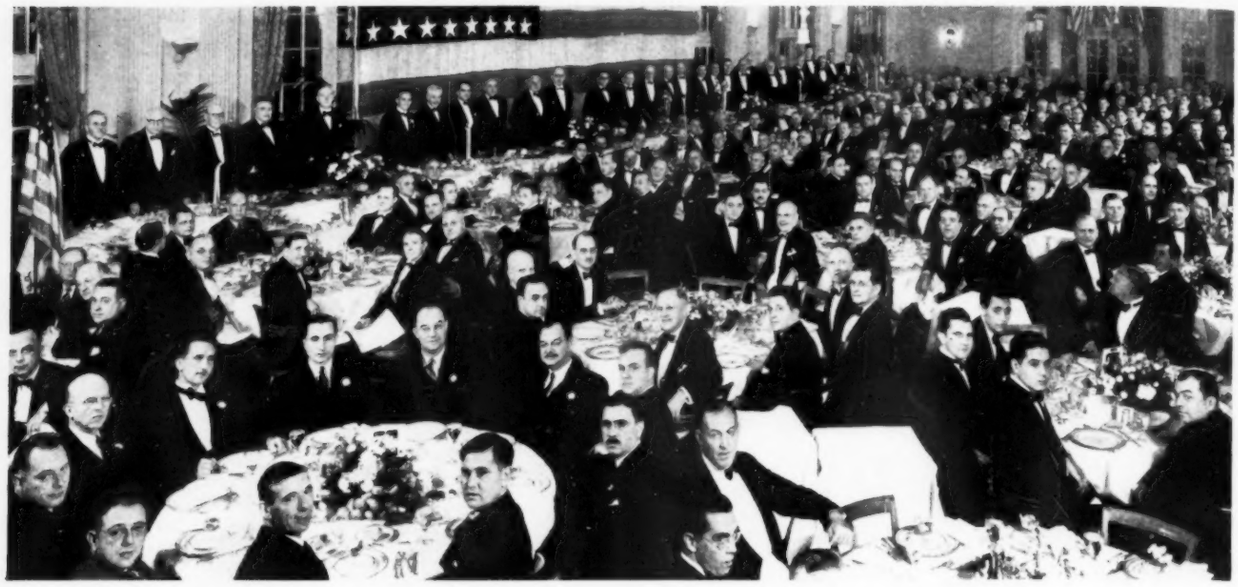
"Gentlemen, a city which can boast of Newton Baker, Benedict Crowell, and Frank Scott is honored indeed."

The presiding officer at the dinner was Col. Winthrop Withington, chief of the Cleveland Ordnance District. Addresses were made by General Crowell, Colonel Withington, and Lieut. Col. L. A. Codd, executive vice-president of the Association.

The following officers of the new chapter were inducted in office at the meeting: Clifford F. Hood, president; John C. McHannan, vice-president; Rufus J. Wysor, vice-president; Maj. Harold M. Reedall, secretary-treasurer. Among those at the speakers' table, in addition to those already named, were: Chester K. Brooks, George Trundle, Jr., Eugene C. Peck, Col. James B. Dillard, Adrian D. Joyce, John W. Linforth, Kent R. Van Horn, Frank Purnell, Carl Gibbs, Brig. Gen. G. M. Barnes, George Brainard, Oscar E. Harder, Hosea T. Bradner, Henry C. Osborn, Samuel Scovill, Ward M. Canaday, Alexander C. Brown, Robert F. Black, George C. Whitlock, and Charles J. Stilwell.

Major Reedall was enthusiastically received by the entire assembly in recognition of his coöperation with industry in the Cleveland area and of his leadership in forming the new chapter.

(*A picture of the Cleveland meeting is on the next page.*)



INAUGURAL MEETING, CLEVELAND POST, ARMY ORDNANCE ASSOCIATION, HOTEL CLEVELAND, OCTOBER 25, 1940

MEETING ON MANUFACTURE OF SHELL

THE Cincinnati Post, Army Ordnance Association; the Cincinnati Section, Machine Shop Practice Division, Metals Engineering Division and Ammunition Group of the American Society of Mechanical Engineers; and Regular Army officers of the Ordnance Department and First Armored Corps joined together on October 16 and 17, 1940, to hold a meeting devoted to discussion of problems encountered in the manufacture of shell. The conferences were held at the Gibson Hotel, Cincinnati, Ohio. Approximately 300 engineers and executives attended the morning and afternoon sessions, the luncheon meeting and dinner of the first day, and the morning session of the second day.

The meeting was called to order at 9:30 A. M. October 16th by Col. James L. Walsh, chairman, National Defense Committee, A.S.M.E., and a director of the Army Ordnance Association. Edward A. Muller, chief of the Cincinnati Ordnance District and a past president of the American Society of Mechanical Engineers, first introduced Lieut. Col. Miles W. Kresge, Ordnance Department, who discussed "Ordnance Shell Steel Specifications" in the light of recent technical developments in the field of metallurgy, forging practice and machine-shop practice. His talk was followed by a period devoted to questions from the floor and informal replies—the number and variety indicating exceptional interest in this subject.

Prof. W. Trinks, of the Carnegie Institute of Technology, then presented a paper on "Heating Shell Billets." Discussion of the points brought out in this paper was lead by Alan Dauch of the George J. Hagan Company of Pittsburgh, Pa., in a manner which stimulated brisk debate and materially increased the value of this contribution to mutual education.

Mr. Muller presided at luncheon and introduced Hon. James Garfield Stewart, Mayor of Cincinnati, who welcomed those in attendance at the meetings and demonstrated a very complete grasp of the fundamental principles underlying a sound program of industrial mobilization. Mayor Stewart was followed by J. B. Doan, president of the Cincinnati Post, Army Ordnance Association, and chairman of the board, American Tool Works Company. Mr. Doan sounded the keynote of the meeting in these words:

"National-defense requirements tend to disrupt industrial routine. In adapting our shops to new demands we must, as business men, be concerned with costs which inevitably increase with expansion. We must take into account in our planning, too, that there will be a world after the war and that it is possible these emergency services will be needed no more.

"We had some profitable years before war demands were made upon us. Most of us would have been quite content to go along with our routine production schedules. The public may think that we have avidly sought war-materials contracts. I sincerely wish the public would understand that our motives in undertaking to produce goods for national defense are essentially patriotic motives.

"May I say further that American manufacturers are willing to undertake a huge production program for national defense and that they are not first of all concerned with profits which may accrue from this production—their willingness to enter into a great program for national defense is motivated primarily by their desire to do what is in their power to make secure the future of our country."

Robert T. Kent presided at the afternoon session at which Prof. Frank Macconochie of the Department of Engineering of the University of Virginia presented an "Analysis of Shell Forging Equipment" which is to be printed by the American Society of Mechanical Engineers for general distribution. The discussion which followed this paper was particularly interesting as it was marked by an announcement by A. Waltman, of the Clearing Machine Corporation, that his company is building an automatic machine, comprising a furnace and forging machine, to produce about 480 shells per hour.

Morris D. Stone of the United Engineering and Foundry Company spoke on the "Flow of Metal During the Forging of Shell," discussion of which was lead by James H. Hopkins.

The main feature of the dinner meeting was a most interesting talk, illustrated by stereopticon slides, by Col. E. N. Harmon, First Armored Corps, Fort Knox, Ky., on "Tanks in Action." His formal remarks were clearly the result of a complete grasp of his subject, and his ready replies to questions from the floor demonstrated his complete familiarity with his subject.

Erik Oberg presided at a session devoted to shell machining. The first paper was presented by Tell Berna, general manager, National Machine Tool Builders Association, on "Coöperation between the Government and the Machine Tool Builders," during which he described the single-purpose shell lathe especially designed for the Army Ordnance Department by the machine-tool industry with a rated capacity of "a shell a minute."

The concluding paper on the program was an "Analysis of Shell Machining Equipment," by Lucien I. Yeomans of Chicago.

WASHINGTON POST

WITH Robert P. Patterson, the Assistant Secretary of War, as honor guest, the Washington Post, Army Ordnance Association, began its program of winter meetings at the Army and Navy Club, Washington, on December 10, 1940. Nearly two hundred members of the Post assembled to greet the Assistant Secretary. Col. F. H. Miles, Jr., president of the Post, presided. Among the special guests were: Maj. Gen. C. M. Wesson, Chief of Ordnance. The Washington Post plans to hold monthly luncheons throughout the coming months. These will be held regularly on the second Tuesday of each month, and will last not more than one hour. Formal addresses were not made at the December meeting but at subsequent luncheons short addresses by authorities on national-defense subjects will be given.

RETIREMENT OF COLONEL MCRAE

AT THE December meeting of the Washington Post, Colonel Miles paid special tribute to Lieut. Col. C. E. McRae, Ord. Res., chief clerk of the Ordnance Department, who will retire, February 26, 1941, from active service having completed nearly forty-two years as a civilian employee of the Department. Colonel McRae also has served as treasurer of the Washington Post since its foundation, November 18, 1925. Colonel McRae's retirement brings to a close a service to Ordnance seldom exceeded by any civilian employee. Born at Mount Holly, Ark., February 26, 1871, he was educated at Little Rock and Tennessee. After serving as secretary to a member of Congress in 1895, he was appointed clerk in the Ordnance Department where he remained continuously until the time of his retirement. His service is best epitomized in his own words. The following is taken from a letter, dated December 10, 1940, addressed by Colonel McRae to all officers and employees of the Ordnance Office.

"After my long service in the Ordnance Department, I would not feel satisfied if I did not have a farewell message for you before my retirement on February 26th, next. I came into the office on July 14, 1898, as a file clerk and have been advanced from time to time to chief clerk on August 26, 1926. This record in itself shows that I have been well treated and to leave without the very kindest feeling would not speak well for me. My interest has always been with the Department and will continue even though separated from it. I know I will miss the office and the personnel greatly, but it is my hope and purpose to drop in occasionally for a visit with old friends.

"Not one member of the Ordnance family as it was when I received my appointment is now in the office. In other words, I am the last limb on the old Ordnance family tree as it then stood. General Flagler was Chief of Ordnance at the time of my appointment, and of the fifteen Chiefs of Ordnance, since 1815, I have served with seven—Generals Flagler, Buffington, Crozier, Williams, Hof, Tschappat, and our present Chief, General Wesson, who has the greatest problem since the creation of the Department, not excepting that of the World War. It is my hope that his administration will be successful. It is of vital concern to all of us that this problem be solved successfully.

"If at any time I can be of further service to the Department or the personnel, it will be given willingly."

In an Ordnance Department order, December 5, 1940, announcing the retirement of Colonel McRae, General Wesson, Chief of Ordnance, wrote: "(His) vast store of knowledge of matters covering the War Department and other governmental agencies, acquired during a lifetime of service with the Ordnance Department; his willingness at all times to place this knowledge at the disposal of those seeking his advice; his untiring devotion to duty, and his many courtesies to the personnel of the Ordnance Department made him a host of friends who will regret his passing from active service. He carries with him the Department's best wishes in his well-earned rest after long, faithful, and meritorious service."

ARMY ORDNANCE adds its tribute to an old friend and loyal supporter. "Mac" represents the best of that zealous band of civilian employees who are devoting their lives to Ordnance throughout the country. Loyalty, dependability and self-sacrifice are characteristic of their service. His exemplary record is an integral part of the Ordnance achievement—military and civilian.

Maj. A. M. Ehrlich, Ord. Res., for many years a member of the Fiscal Division, Office of the Chief of Ordnance, has been appointed chief clerk to succeed Colonel McRae.

NEW MEMBERS

DURING the period October 1, 1940, to November 30, 1940, inclusive, the following applicants were admitted to membership in the Army Ordnance Association: N. D. Abbey, Toledo, Ohio; H. L. Abbot, Bethlehem, Pa.; H. H. Adams, Evanston, Ill.; John Q. Adams, Detroit, Mich.; W. M. Albaugh, Cleveland, Ohio; Harry P. Alleman, Upper Darby, Pa.; Henry A. Allen, Chicago, Ill.; James E. Allison, Milwaukee, Wis.; R. P. Allison, Schenectady, N. Y.; Adam Altglass, Atlanta, Ga.; Herman O. Amble, Berwick, Pa.; J. E. Anderson, Columbus, Ohio; A. J. Armstrong, Fort Worth, Tex.; George S. Armstrong, New York, N. Y.; W. F. Armstrong, Detroit, Mich.; J. A. Arnold, Bethlehem, Pa.; L. P. Ashley, Chicago, Ill.; J. N. Ashworth, Cleveland, Ohio; W. F. Aske, Detroit, Mich.; Franklin M. Askew, Fort Knox, Ky.; Gilbert S. Atkinson, Terre Haute, Ind.; G. R. Auld, Dayton, Ohio; Dwight E. Austin, New York, N. Y.; Fred. W. Ayers, Upper Darby, Pa.

C. W. Babb, Columbus, Ohio; Howard O. Babcock, Buffalo, N. Y.; Walter K. Bailey, Cleveland, Ohio; Robert W. Bailey, Philadelphia, Pa.; C. H. Baker, Euclid, Ohio; G. A. Baker, Dayton, Ohio; C. A. Baldwin, Utica, N. Y.; L. L. Baldwin, Akron, Ohio; Donavan S. Bancroft, El Monte, Calif.; G. H. Bancroft, Toledo, Ohio; D. K. Banker, Dayton, Ohio; E. H. Barder, Akron, Ohio; James H. Barnes, Grosse Pointe, Mich.; D. S. Barrows, Rochester, N. Y.; W. M. Barrows, Jr., Bethlehem, Pa.; Will L. Baughman, Los Angeles, Calif.; W. G. Bausch, Princeton, N. J.; Julius L. Bayer, Cleveland, Ohio; A. J. Bayles, Maywood, Ill.; C. R. Beardsley, New York, N. Y.; Joseph G. Becker, Virginia Beach, Va.; Walter C. Beckjord, Greenwich, Conn.; Waldron C. Beekley, West Hartford, Conn.; Frederick W. Beinecke, Madison, N. J.; Guy C. Beishline, Berwick, Pa.; Henderson M. Bell, III, Cleveland, Ohio; F. W. Belz, New York, N. Y.; John Bermingham, San Francisco, Calif.; C. H. Betzenberger, Dunellen, N. J.; G. M. Bicknell, St. Louis, Mo.; E. G. Biechler, Dayton, Ohio; Irvin A. Billiar, Abington, Pa.; Thomas S. Bishop, III, Allentown, Pa.; Ward Blackburn, Los Angeles, Calif.; E. F. Bodine, Bethlehem, Pa.; Jerry Bohaboy, Chicago, Ill.; I. C. Bolton, Cleveland, Ohio; Howard Booher, Washington, D. C.; James P. Boore, Beaver Falls, Pa.; W. F. Boore, Jr., Bethlehem, Pa.; E. N. Boswell, Dunkirk, N. Y.; R. R. Braggins, Cleveland, Ohio; R. T. Branch, New York, N. Y.; Richard E. Brauer, St. Louis, Mo.; E. D. Brauns, Philadelphia, Pa.; Thomas J. Bray, Jr., Sewickley, Pa.; Thomas P. Breen, Manhasset, N. Y.; Dennis F. Brennan, Keene, N. H.; N. Brewer, Utica, N. Y.; Richard T. Brice, Washington, D. C.; R. R. Bright, Bethlehem, Pa.; R. J. Brillhart, Columbus, Ohio; A. B. Brown, Bethlehem, Pa.; R. T. Brown, Akron, Ohio; Sandford Brown, New York, N. Y.; Warren Brown, Florence, N. J.; G. E. Brunner, Akron, Ohio; Floyd D. Bryon, St. Louis, Mo.; H. D. Bubb, Cleveland, Ohio; Elisha Bunting, New Bern, N. C.; William J. Burger, Cleveland, Ohio; G. A. Burns, Washington, D. C.; W. F. Byrns, Washington, D. C.

Flavian P. Calabrese, St. Louis, Mo.; J. T. Callahan, Akron, Ohio; Louis A. Camerota, Florence, N. J.; John R. Campbell, Jr., East Newark, N. J.; Calvert Carey, New York, N. Y.; W. A. Carlile, Jr., Columbus, Ohio; Robert Carnwath, Jr., Jenkintown, Pa.; Samuel W. Carnwath, Rydal, Pa.; R. E. Carpenter, Toledo, Ohio; W. Y. Carter, Newark, N. J.; L. V. Cart-

wright, Cleveland, Ohio; J. F. Cast, Akron, Ohio; John W. Chapman, Elizabeth, N. J.; A. N. Chase, Webb City, Mo.; L. H. Chenoweth, Akron, Ohio; A. Clark, Bethlehem, Pa.; Harry K. Clark, Worcester, Mass.; N. R. Clark, Bethlehem, Pa.; R. W. Clark, Bethlehem, Pa.; Wallace Clark, New York, N. Y.; L. M. Clegg, Cleveland, Ohio; John R. Clendenning, Allentown, Pa.; Harry G. Colby, Fairfield, Conn.; G. F. Cole, Cleveland, Ohio; Robert R. Cole, Anniston, Ala.; William C. Coles, Jr., Moorestown, N. J.; John L. Collins, Syracuse, N. Y.; J. L. Collyer, Akron, Ohio; A. T. Colwell, Cleveland, Ohio; F. J. Comerford, Rochester, N. Y.; K. H. Condit, Princeton, N. J.; G. F. Coope, Carlsbad, N. Mex.; F. B. Copeland, Batavia, N. Y.; Frederick W. Copeland, Michigan City, Ind.; Edward J. Costa, Baltimore, Md.; M. F. Cotes, Lansing, Mich.; George W. Coughlin, New York, N. Y.; H. D. Coulton, Cleveland, Ohio; Theodore G. Coyle, Detroit, Mich.; Alex J. Crawford, New Haven, Conn.; F. C. Crawford, Cleveland, Ohio; P. P. Crisp, Akron, Ohio; Harry K. Cross, Providence, R. I.; William N. Crout, Shaker Heights, Ohio; Eugene J. Curtis, Clinton, Iowa; Thomas Curtiss, Rosemont, Pa.

F. J. Daley, Chicago, Ill.; Mark A. Daly, Buffalo, N. Y.; C. A. Dana, Toledo, Ohio; M. E. Dank, Cleveland, Ohio; William J. Darmody, Washington, D. C.; John H. Daum, S. Orange, N. J.; G. N. Davidson, Chicopee Falls, Mass.; Elliot V. Davis, Allentown, Pa.; G. F. Davis, Indianapolis, Ind.; Harlan H. Davis, Chicago, Ill.; Putnam Davis, New York, N. Y.; L. Arthur Dawson, Dorchester, Mass.; W. H. Dawson, Augusta, Ga.; Buel W. Dean, Pittsfield, Mass.; John B. Dean, West Point, N. Y.; Clarence R. DeBow, Jr., Parlin, N. J.; W. B. DeForest, New York, N. Y.; W. C. DeGraff, Cleveland, Ohio; Thomas J. Dempsey, Jr., St. Louis, Mo.; J. H. Detweiler, Princeton, N. J.; Donald C. Dilley, Cleveland, Ohio; John E. Dixon, East Orange, N. J.; H. H. Doehler, New York, N. Y.; Stanley T. Dolan, Syracuse, N. Y.; Thomas Dolan, IV, Devon, Pa.; H. V. Donohoe, Bethlehem, Pa.; John V. N. Dorr, Westport, Conn.; Archibald Douglas, New York, N. Y.; L. R. Downie, Detroit, Mich.; L. W. Downie, Detroit, Mich.; Charles R. Downs, New York, N. Y.; T. O. Duggan, Cleveland, Ohio; George W. Dulany, Jr., Clinton, Iowa; W. M. Duncan, Chicago, Ill.; Ernest Dunford, Normandy, Mo.; Hugh L. Dunn, St. Louis, Mo.; Lewis C. Dunn, Detroit, Mich.; Adelbert W. Duskin, Pasedena, Md.

John F. Eaton, Tulsa, Okla.; Leslie B. Eby, Detroit, Mich.; J. F. Eckert, Cleveland, Ohio; C. L. Von Egloffstein, New York, N. Y.; E. L. Ehrke, San Francisco, Calif.; A. J. Eichler, New York, N. Y.; Theodore H. Eickhoff, Cleveland, Ohio; Victor Emanuel, New York, N. Y.; Francis H. Engel, Chevy Chase, Md.; Henry B. Ensign, Berwick, Pa.; G. R. Ericson, St. Louis, Mo.; O. T. Ericson, Chicago, Ill.; Henry S. Evans, Harrisburg, Pa.; Morris S. Evans, Buffalo, N. Y.

J. P. Faber, Dunellen, N. J.; William Fairhurst, Toledo, Ohio; Stephen P. Farish, Houston, Tex.; Roy H. Faulkner, Cleveland, Ohio; Alfred H. Ferrandou, Washington, D. C.; Walter S. Finlay, Jr., New Rochelle, N. Y.; K. Finsterbusch, New York, N. Y.; A. Fischer, Clayton, Mo.; Albert P. Fischer, Cincinnati, Ohio; Louis G. Fischer, Swarthmore, Pa.; John P. Fitch, Hartford, Conn.; Burtner Fleeger, Tulsa, Okla.; H. J. Fletcher, Chicago, Ill.; Paris R. Forman, Rahway, N. J.; B. Norton Foster, Keene, N. H.; H. W. Foulds, New York, N. Y.; Benjamin Frankel, Fairfield, Ill.; D. W. Fraser, New York, N. Y.; J. W. Frazer, Toledo, Ohio; Walter J. Frederick, Cincinnati, Ohio; George T. French, Bettendorf, Iowa; R. J. Freter, Columbus, Ohio; Walter Fried, Great Neck, L. I., N. Y.; Robert E. Frost, Pittsburgh, Pa.; H. E. Fuller, Cleveland, Ohio; H. D. Frueauff, Jr., Chicago, Ill.; L. S. Fulton, St. Louis, Mo.

Lester W. Gallup, Providence, R. I.; Harry F. Gammeter, Cleveland Heights, Ohio; F. Royal Gammon, Cleveland, Ohio; R. D. Garden, Chicago, Ill.; Ralph E. Gates, Metuchen, N. J.; Mark H. Gathmann, Catonsville, Md.; M. R. Gault, Chicago, Ill.; H. Geiger, Reading, Pa.; W. H. Gibb, Philadelphia, Pa.; Willis A. Gibbons, Montclair, N. J.; A. E. Gibbs, Cleveland, Ohio; Carl C. Gibbs, Cleveland, Ohio; C. D. Gibson, Norwalk, Conn.; H. W. Gilbert, Cleveland, Ohio; Howard H. Gilliam, Paterson, N. J.; Alfred G. Glode, McKeesport, Pa.; E. R. Godfrey, Dayton, Ohio; A. L. Godlove, Bethlehem, Pa.; C. F. Goldcamp, Pittsburgh, Pa.; George G. Goodling, Jr., York, Pa.; Robert H. Gove, Battle Creek, Mich.; C. Henry Goulette, Tucson, Ariz.; Bernard J. Grad, Newark, N. J.; George E. Grafton, Wellsville, Ohio; George A. Graham, Boston, Mass.; M. P. Graham, Detroit, Mich.; T. G. Graham, Akron, Ohio; E. B. Gratton, Riverside, Ill.; Harland A. Gray, Red Bank, N. J.; Samuel C. Green, Des Moines, Iowa; Isadore Greenblatt, Winnetka, Ill.; John C. Grindlay, Plainfield, N. J.; Joseph A. Grow, Jr., Bradford, Pa.; P. M. Gunsaulus, Akron, Ohio; Arthur A. Gustafson, Minneapolis, Minn.; A. G. Gutmueller, Toledo, Ohio; W. G. Gutmueller, Pottstown, Pa.

Raymond C. Haimbaugh, North Tonawanda, N. Y.; F. P. Hall, Jr., Toledo, Ohio; Charles F. Hallick, Rochester, N. Y.; George S. Hamilton, Chicago, Ill.; Robert E. Hamilton, New York, N. Y.; John M. Hancock, Scarsdale, N. Y.; Milburn C. Hansen, Chicago, Ill.; Waldo G. Harbert, Saginaw, Mich.; George E. Harding, Boston, Mass.; Stanley R. Hardwick, Riverside, R. I.; Norris Harkness, New York, N. Y.; G. W. Harper, Cleveland, Ohio; Chester R. R. Harris, New York, N. Y.; C. Harrison, North Canton, Ohio; P. C. K. Harrison, Bridgeport, Conn.; William F. Hart, Pittsburgh, Pa.; A. H. Harter, St. Louis, Mo.; J. T. Hartson, Baltimore, Md.; Robert K. Haskell, Watertown, Mass.; J. F. Hattersley, North Canton, Ohio; F. L. Haushalter, Akron, Ohio; J. C. Hays, New York, N. Y.; S. P. Hazard, Florence, Burlington County, N. J.; Stanley A. Hedberg, Williamsport, Pa.; Ernest E. Hedler, Jr., Wyncote, Pa.; H. G. Heedy, Cleveland, Ohio; Arthur E. Heffelfinger, New York, N. Y.; O. C. Heffner, North Canton, Ohio; John Adam Helfert, Balboa, C. Z.; Gilmore N. Herman, East Chicago, Ind.; P. L. Hexter, Cleveland, Ohio; F. F. Hickey, Utica, N. Y.; Robert I. Hicks, Syracuse, N. Y.; Lester C. Higbee, Troy, N. Y.; W. C. Higginbottom, Philadelphia, Pa.; L. C. Higgins, Cleveland, Ohio; P. D. Hileman, Bell, Calif.; Arthur M. Hill, Charleston, W. Va.; Edward B. Hiltner, Los Angeles, Calif.; Elstner Hilton, Washington, D. C.; W. A. Himmelwright, Bethlehem, Pa.; Hobart V. Hodge, Monroe, Mich.; J. L. Hoffman, Detroit, Mich.; Edward F. Hollander, Providence, R. I.; W. B. Holton, Jr., New York, N. Y.; Justus M. Home, West Point, N. Y.; F. G. Hoover, North Canton, Ohio; H. W. Hoover, North Canton, Ohio; Frederick C. Horner, New York, N. Y.; Livingston W. Houston, Troy, N. Y.; J. O. Houze, Cicero, Ill.; Frank Atherton Howard, New York, N. Y.; P. J. Howard, Melrose Park, Ill.; Robert T. Howes, Akron, Ohio; W. H. Huelster, Oak Park, Ill.; Andrew H. Hughes, Philadelphia, Pa.; D. L. Hume, Bethlehem, Pa.; J. W. Humphrey, Dayton, Ohio; William Hurwitz, Fairfield, Ill.; William J. Huston, Monessen, Pa.; Francis L. Hutsler, Los Angeles, Calif.; Arthur D. Hyde, Minneapolis, Minn.; Eugene J. Hynes, New York, N. Y.; Joseph F. Igoe, Newark, N. J.; Arthur H. Ingle, Rochester, N. Y.

Del E. Jack, Dayton, Ohio; Clarence R. Jackson, Seattle, Wash.; O. Jacobsen, Dayton, Ohio; Harry R. Jacobson, New York, N. Y.; Robb Warren James, Cleveland, Ohio; Alfred Storm Jameson, Chicago, Ill.; C. E. Jamieson, Grosse Pointe Shores, Mich.; H. Johnson, North Canton, Ohio; Raymond C. Johnson, Hamilton, Ohio; Adrian D. Joyce, Cleveland, Ohio; Dwight P. Joyce, Cleveland, Ohio; J. T. S. Jurgenson, Flint, Mich.; Raymond W. Justice, Youngstown, Ohio.

W. V. Kahler, Chicago, Ill.; Julius Z. Kaplan, New York, N. Y.; Samuel Floyd Keener, Salem, Ohio; Raymond H. Keith, New York, N. Y.; Alexander S. Keller, Bloomfield, Conn.; Charles W. Kellogg, New York, N. Y.; G. W. Kennedy, Detroit, Mich.; M. C. Kennedy, Marion, Ind.; R. Oakley Kennedy, Troy, N. Y.; William E. Kennedy, Ridgewood, N. J.; Orum R. Kerst, Worcester, Mass.; James J. Kerrigan, Summit, N. J.; E. P.

Kerruish, Cleveland, Ohio; Andrew King, Narberth, Pa.; E. J. Kingsbury, Keene, N. H.; Dr. Bradley H. Kirschberg, Schenectady, N. Y.; Lloyd Kitchel, Wilmington, Del.; J. H,. Klasey, St. Louis, Mo.; A. C. Klein, Boston, Mass.; Deppen Kline, Hamburg, N. Y.; Franklin H. Knox, Pitman, N. J.; F. J. Koegler, New York, N. Y.; E. H. Koller, Dunellen, N. J.; Israel Kramer, Trenton, N. J.; Robert Kramer, Washington, D. C.; Edward D. Krumm, Maplewood, N. J.; C. E. Kubelik, Cleveland, Ohio; George B. Kutz, York, Pa.

E. La Crosse, Boston, Mass.; R. I. Laggren, New York, N. Y.; E. J. Lame, Florence, Burlington County, N. J.; Joseph F. Landrigan, Hartford, Conn.; C. L. Lane, Kewanee, Ill.; Oscar Lapirow, Cincinnati, Ohio; Fred R. Large, Rochester, N. Y.; Preston Thompson Large, Pittsburgh, Pa.; Raymond J. Larson, W. Hartford, Conn.; E. D. Latimer, Jr., Bethlehem, Pa.; Edwin E. Laubscher, Cleveland, Ohio; Dominick LaValle, New York, N. Y.; Arnold W. Lebow, New York, N. Y.; Frank T. Leilich, Baltimore, Md.; C. W. Leguillon, Akron, Ohio; Frank Lejeune, Detroit, Mich.; Austin T. Levy, Harrisville, R. I.; H. S. Lewis, Reading, Pa.; Harry R. Lewis, Warren, Pa.; N. S. Lincoln, Cleveland, Ohio; Walter F. Linders, St. Louis, Mo.; James Lindsay, Irvington, N. J.; C. H. Lloyd, Grand Rapids, Mich.; A. H. Lockley, New York, N. Y.; Edmund J. Lomazzo, Norwalk, Conn.; Charles Carl Lo Presti, Astoria, L. I., N. Y.; J. R. Lotz, New York, N. Y.; J. J. Loughran, Pottstown, Pa.; E. E. Louis, Cleveland, Ohio; L. F. Lowry, Toledo, Ohio; R. Archer Ludlow, South Orange, N. J.; H. Luetkemeyer, Cleveland, Ohio; Albert W. Luhrs, South Orange, N. J.

E. A. MacDonald, Utica, N. Y.; F. C. MacKrell, Washington, D. C.; Russell J. Mac Mullan, Rosemont, Pa.; R. R. Macy, Bethlehem, Pa.; James L. Madden, Short Hills, N. J.; O. J. Maha, Chicago, Ill.; J. C. Mahannah, Detroit, Mich.; Peter Maher, Cleveland, Ohio; W. T. Mainwaring, Bethlehem, Pa.; Tracy Manville, Pittsburgh, Pa.; Charles Marcus, New York, N. Y.; Alex Marks, New York, N. Y.; Howard Marshutz, St. Louis, Mo.; Allen Martin, New York, N. Y.; Frank D. Martin, Newark, N. J.; Benjamin B. Mason, Davenport, Iowa; Willard J. Mason, Washington, D. C.; A. J. Mather, Kewanee, Ill.; Herbert Luke Mausk, Shaker Heights, Ohio; J. J. McCabe, Glendale, Calif.; E. A. McBride, Cleveland, Ohio; Kenneth W. McConky, New York, N. Y.; Robert J. McCormick, Waterbury, Conn.; C. H. McCrea, Cleveland, Ohio; L. McCutcheon, Dayton, Ohio; R. J. McGregor, Bethlehem, Pa.; A. R. McHenry, Depew, N. Y.; Chester M. McKeen, Oak Park, Ill.; Charles McKinley, Cleveland Heights, Ohio; W. W. McLean, Princeton, N. J.; Wilfred McManus, Chicago, Ill.; C. W. McMullen, Dayton, Ohio; Thomas A. McNeil, Norwalk, Conn.; E. F. Mechlin, Washington, D. C.; Frederick C. Melick, New York, N. Y.; Ward Melville, New York, N. Y.; Harvey B. Mims, Chicago, Ill.; Edward G. Miner, Rochester, N. Y.; Riley P. Miner, Curtis Bay, Md.; Hugh C. Minton, Jr., Tarentum, Pa.; George M. Moffett, Queenstown, Md.; E. C. Mogford, Toledo, Ohio; G. F. Monaghan, Dunellen, N. J.; L. J. Moncrieff, Toledo, Ohio; Wallace T. Montague, Worcester, Mass.; L. F. Moody, Princeton, N. J.; R. E. Mooney, Cleveland, Ohio; F. H. Morehead, New York, N. Y.; John B. Moreton, Rochester, N. Y.; W. H. Moriarty, Cleveland, Ohio; L. B. Morrell, Kansas City, Mo.; Chester Morrill, Jr., Washington, D. C.; Fred J. Morris, San Francisco, Calif.; John G. Morrissey, New York, N. Y.; Hudson T. Morton, Ann Arbor, Mich.; J. T. W. Moseley, St. Louis, Mo.; Frank E. Mott, Larchmont, N. Y.; A. G. Mould, Cleveland, Ohio; William J. Mulcahy, Philadelphia, Pa.; Cornelius De Roo Mulder, Muskegon, Mich.; W. Muller, Dunellen, N. J.; Richard F. Mullins, Chicago, Ill.; Arden J. Mummert, St. Louis, Mo.; Burton David Munhall, Cleveland, Ohio; D. P. Murphy, Depew, N. Y.; Gerald L. Murphy, New York, N. Y.; Ray Murphy, New York, N. Y.

C. J. Nagel, Syracuse, N. Y.; Grover E. Nagle, York, Pa.; Louis Edw. Narbonne, Philadelphia, Pa.; J. W. Needles, Bethlehem, Pa.; Donald M. Nelson, Washington, D. C.; Reese Nelson, Park Ridge, Ill.; P. L. Nestleroth, Bethlehem, Pa.; E. B. Newill, Dayton, Ohio; C. T. Newport, Cleveland, Ohio; Frederick W. Nichol, New York, N. Y.; E. H. Nieman, St. Louis, Mo.; J. L. Noon, Cleveland, Ohio.

H. E. Oatis, Toledo, Ohio; W. H. Oldacre, Chicago, Ill.; J. M. Olmsted, Los Angeles, Calif.; Oscar F. Olsen, Northport, N. Y.; J. E. Orloff, Dunellen, N. J.; Chant Owen, New Haven, Conn.; William Bruckner Owens, Decatur, Ga.

C. Pack, New York, N. Y.; J. E. Padgett, Toledo, Ohio; J. V. O. Palm, Cleveland, Ohio; Wilson Palmer, Beverly, Mass.; G. Park, Detroit, Mich.; G. E. Parsons, Jr., Bethlehem, Pa.; Lewis M. Parsons, Pittsburgh, Pa.; H. E. Passmore, McKeesport, Pa.; Earl S. Patch, Dayton, Ohio; James A. Patch, Hartford, Conn.; Morehead Patterson, New York, N. Y.; D. M. Pattison, Cleveland, Ohio; William H. Pauly, Sheboygan Falls, Wis.; John J. Pavlak, Cleveland, Ohio; James L. Paxton, Jr., Omaha, Nebr.; Glenn B. Payne, Utica, N. Y.; D. J. Peake, Florence, Burlington County, N. J.; J. W. Pearce, Toledo, Ohio; John Pearce, Utica, N. Y.; Alfred W. Petchaft, St. Louis, Mo.; Carl B. Peters, New York, N. Y.; N. B. Petersen, Columbus, Ohio; C. D. Peterson, Toledo, Ohio; E. G. Peterson, Chicago, Ill.; M. F. Peterson, St. Louis, Mo.; V. W. Peterson, Chicago, Ill.; J. F. Pfeffer, Jr., Bethlehem, Pa.; W. H. Phillips, Pittsburgh, Pa.; W. J. Phillips, Rochester, N. Y.; N. E. Philpot, New York, N. Y.; T. J. Phipps, Los Angeles, Calif.; T. H. Pickering, Batavia, N. Y.; Bruce Pierce, Benicia, Calif.; L. H. Pillion, New York, N. Y.; K. C. Plasterer, Lansing, Mich.; John M. D. Poisker, Philadelphia, Pa.; R. V. Polen, Dayton, Ohio; Cleve H. Pomeroy, Cleveland, Ohio; Harold D. Pomeroy, North Bergen, N. J.; H. K. Porter, Harrison, N. J.; B. E. Poste, Columbus, Ohio; Grosvenor F. Powell, El Paso, Tex.; Marselis Powell, W. Hartford, Conn.; James A. Pray, Buffalo, N. Y.; Harold J. Preble, Alton, Ill.; Wilbur D. Prescott, Cleveland, Ohio; Raymond B. Prouty, Hartford, Conn.; Raymond S. Pruitt, New York, N. Y.; I. T. Pryor, Princeton, N. J.; Frank Purnell, Youngstown, Ohio.

L. F. Rahm, Princeton, N. J.; Fred J. Ramsey, Harrisburg, Pa.; Marshall D. Raymond, Cleveland, Ohio; Carl L. Reasel, Syracuse, N. Y.; E. C. Redlin, Cleveland Heights, Ohio; Edwin A. Rehberger, Newark, N. J.; J. I. Reid, Rochester, N. Y.; William Charles Reid, Flushing, L. I., N. Y.; William F. Reinlie, Chicago, Ill.; George W. Reitwiesner, Aberdeen Proving Ground, Md.; Thomas H. Remington, Rochester, N. Y.; G. A. Renard, New York, N. Y.; William E. Renner, Ann Arbor, Mich.; Frank W. Renwick, Jr., Evanston, Ill.; R. M. Rex, Columbus, Ohio; William Reynolds, New York, N. Y.; S. R. Rhoads, Philadelphia, Pa.; Arthur W. Richardson, New Canaan, Conn.; Ralph W. Richmond, Edgewood, Providence, R. I.; Byron Rife, San Antonio, Tex.; Eugene N. Riotte, Brooklyn, N. Y.; Geo. W. Ritter, Toledo, Ohio; J. H. Roberts, New York, N. Y.; Malcolm Roberts, Shaker Heights, Ohio; G. H. Robertson, Cleveland, Ohio; A. P. Robinson, Dunellen, N. J.; J. W. Robinson, Pittsburgh, Pa.; Henry A. Roemer, Pittsburgh, Pa.; DeHaven Ross, Riverside, Conn.; Kenwood Ross, Springfield, Mass.; John F. Rowley, Jr., Baltimore, Md.; A. J. Rubin, St. Louis, Mo.; E. Roy Russell, Florence, Burlington County, N. J.; William R. Russell, Washington, D. C.

H. R. Sago, Washington, D. C.; G. S. Salzman, Cleveland, Ohio; Donald S. Sammis, Stratford, Conn.; M. H. Sans, Waukegan, Ill.; Frank N. Sarber, Louisville, Ky.; J. A. Sauer, New York, N. Y.; Daniel J. Saunders, Kew Garden, New York, N. Y.; Arthur B. Schellenberg, St. Louis County, Mo.; A. W. Schenck, Chicopee Falls, Mass.; R. C. Schenck, Dayton, Ohio; Joseph W. Schiffenhaus, Newark, N. J.; W. H. Schlueter, St. Louis, Mo.; E. C. Schmidt, North Canton, Ohio; R. F. Schmidt, Dayton, Ohio; F. J. Schmitt, Oak Park, Ill.; Fred J. Schnakenberg, St. Louis, Mo.; Fred Schroeder, Chicago, Ill.; C. H. Schumacher, Bethlehem, Pa.; Charles F. Schwader, Rochester, N. Y.; S. M. Schweller, Dayton, Ohio; Fred J. Seither, Newark, N. J.; H. G. Senning, Dedham, Mass.; C. H. Shaffer, Depew.

N. Y.; C. H. Shattuck, Los Angeles, Calif.; Hugh Lawson Shaw, Union, N. J.; Daniel M. Sheaffer, Wayne, Pa.; E. Sheenan, Dunellen, N. J.; Washington Kyle Sheffield, New London, Conn.; John E. Sheridan, W. Hartford, Conn.; Donald H. Sherwood, Baltimore, Md.; E. H. Sherwood, Cleveland, Ohio; Alvin E. Shetler, Akron, Ohio; George Shiner, Buffalo, N. Y.; John Shotwell, Toledo, Ohio; R. J. Shouvlin, Penn Valley, Pa.; E. C. Shurtleff, Cleveland, Ohio; C. Sinclair, Detroit, Mich.; P. Slivinski, Chicago, Ill.; Harold D. Slosson, San Gabriel P. O., Calif.; J. O. Small, Cleveland, Ohio; D. G. Smellie, North Canton, Ohio; Albert C. Smith, Philadelphia, Pa.; Ben D. Smith, Indianapolis, Ind.; Charles C. Smith, Devon, Conn.; K. D. Smith, Akron, Ohio; M. W. Smith, Dayton, Ohio; Robert S. Smith, Chicago, Ill.; J. E. Snowberger, Toledo, Ohio; F. L. Snyder, Columbus, Ohio; A. E. Sorenson, Princeton, N. J.; R. J. Southwell, Bridgeport, Conn.; C. Nelson Sparks, Norwalk, Conn.; Stanley W. Sparks, Norwalk, Conn.; A. L. Spencer, Shaker Heights, Ohio; Hugh L. Spence, Cleveland, Ohio; E. Spoerry, Jr., Cleveland, Ohio; A. P. Spooner, Bethlehem, Pa.; G. F. Stanford, Bellewood, Ill.; F. A. Stevens, New York, N. Y.; H. Stewart, Utica, N. Y.; Edwin A. Stillman, Roselle, N. J.; Clifford S. Stilwell, Cleveland, Ohio; Lauson Stone, Pittsburgh, Pa.; Frank Sturges, Elmhurst, Ill.; Lee Sturgess, Melrose Park, Ill.; Robert W. Suman, Chicago, Ill.; Gunnar Swahnberg, Keene, N. H.; C. E. Swartz, Cleveland, Ohio; J. A. Sweeney, Detroit, Mich.; Howard C. Sykes, Englewood, N. J.; C. J. Symington, New York, N. Y.

R. G. Taylor, Bethlehem, Pa.; John T. Taylor, Pittsburgh, Pa.; Philip B. Taylor, Upper Montclair, N. J.; Richard G. Taylor, Chicago, Ill.; Walter J. Taylor, Rockford, Ill.; Lewis R. Tharp, Chicago, Ill.; John V. Therrell, Jr., Washington, D. C.; R. P. Thomas, Jr., Cleveland, Ohio; Glenn Thiersch, Peoria, Ill.; H. B. Tobias, Washington, D. C.; E. F. Tomlinson, Akron, Ohio; Stanley M. Tracy, Princeton, N. J.; Emil A. Tregzger, Scarsdale, N. Y.; W. C. Trout, Lufkin, Tex.; Frederick H. Tyler, Dayton, Ohio; Nathan I. Tyler, Brooklyn, N. Y.

J. Y. Umbarger, Philadelphia, Pa.; Robert G. Urbach, Cape Henry, Va.; Harold L. Usher, New York, N. Y.; F. Russell Valpez, Washington, D. C.; J. D. Van Blarcom, Bethlehem, Pa.; Addison F. Vars, Buffalo, N. Y.; Harcourt C. Vernon, Wilmington, Del.; Charles A. Verschoor, Ann Arbor, Mich.; Elwyn C. Vevier, St. Louis, Mo.; Raymond A. Vidinghoff, Narberth, Pa.; Joseph L. Vieira, Beverly Hills, Calif.; H. E. Volz, St. Louis, Mo.; L. W. Voorhees, Dunellen, N. J.

C. L. Waddell, New York, N. Y.; J. P. Walker, Maywood, Ill.; Robert J. Walker, La Grange, Ill.; Robert W. Walker, Pelham Manor, N. Y.; W. S. Walker, New York, N. Y.; William H. Walker, Newark, N. J.; F. I. Walsh, Princeton, N. J.; A. J. Walters, Dayton, Ohio; David A. Walters, Toledo, Ohio; Howard Warburton, North Canton, Ohio; Frederick F. Ward, Beaver Falls, Pa.; Gordon K. Ware, Chicago, Ill.; Ralph Ware, Chicago, Ill.; Robert R. Ware, Chicago, Ill.; Robert R. Ware, Jr., Chicago, Ill.; Walter Ware, Chicago, Ill.; C. L. Wareing, Cleveland, Ohio; John F. Weber, Philadelphia, Pa.; Hugh H. C. Weed, St. Louis, Mo.; Reginald A. Wentworth, New York, N. Y.; Howard J. White, Wilmington, Del.; John A. White, Baltimore, Md.; R. H. White, Schenectady, N. Y.; M. J. Whitson, New York, N. Y.; Robert L. Wickes, Schenectady, N. Y.; Herman B. Williams, Dudley, Mass.; M. R. Williams, Bellevue, Pa.; M. S. Perry Williams, Detroit, Mich.; R. Arthur Williams, Cleveland, Ohio; C. H. Willis, Princeton, N. J.; L. T. Willison, Mt. Lebanon, Pa.; Howard M. Wilson, McKees Rocks, Pa.; L. R. Wilson, Dunellen, N. J.; Robert E. Wilson, New York, N. Y.; Otis T. Wingo, Jr., Washington, D. C.; Carl E. Winter, Cleveland, Ohio; J. Arthur Winter, New York, N. Y.; Harold E. Wirth, Washington, D. C.; Howard E. Wise, Cleveland, Ohio; A. F. Witte, Cleveland Heights, Ohio; Edmund G. Wodrich, Burbank, Calif.; Bernard J. Wolfe, Rochester, N. Y.; Campbell Wood, Washington, D. C.; J. H. Wood, Philadelphia, Pa.; William Woodburn, Washington, D. C.; Roy V. Woodworth, St. Louis, Mo.; Walton L. Woody, Sharon, Pa.; G. B. Work, Reading, Pa.; J. D. Wright, Cleveland, Ohio; Otto M. Yetter, Newark, N. J.; C. Mervyn Young, Wynnewood, Pa.; E. R. Zabriskie, Toledo, Ohio; Leonard E. Zongher, Washington, D. C.

NECROLOGY

MAJ. CHARLES FRED MORLEY, a director of the Rochester Post, Army Ordnance Association, died at his home in Rochester, October 31, 1940. He was president of the Morley Machinery Corporation of Rochester and was an authority on artillery shell manufacture.

Major Morley was born in Kitchener, Ont. He began his industrial service as production foreman at the Westinghouse Electric Company plant, East Pittsburgh, Pa. During the World War he was in charge of production at the Symington Company, makers of large quantities of field-artillery shells during the World War at Rochester and Chicago. In Chicago he organized and began production of 155-mm. shell, a vital war product. Major Morley was an active member of the Rochester Post of the Association and was one of its founders. A well-known manufacturer of machinery, he was closely identified with artillery shell manufacture until the time of his death. He was frequently called into consultation by the Ordnance Department at Washington and at the arsenals. Fred Morley was a familiar figure at meetings of the Army Ordnance Association throughout the years, and he will be missed by his many friends.

COL. GEORGE BRINTON McCLELLAN, a charter member of the Army Ordnance Association and a director of the Washington Post, died at his home in Washington, November 30, 1940. Colonel McClellan was the son of Gen. George B. McClellan, Commander in Chief of the Union Armies at the outset of the Civil War.

Colonel McClellan was born in Dresden, Saxony, November 23, 1865. He was graduated from Princeton University and while a student at that institution he wrote political articles for several of the leading New York daily papers. He was admitted to the New York Bar in 1892 and entered upon a political career the following year when he was made president of the New York Board of Aldermen. He served as a member of the House of Representatives from New York from 1895 to 1903. He was elected Mayor of the City of New York January 1, 1904, which office he held until December 31, 1909. He succeeded President Cleveland as Stafford Little Lecturer on Public Affairs at Princeton in 1908.

He returned to Princeton in 1911 as public-affairs lecturer and the following year became professor of economic history and occupied that chair until 1930, when he was made professor emeritus. Colonel McClellan also lectured at Cornell, Washington and Jefferson, Rutgers and the University of North Carolina. During the World War he served overseas and was honorably discharged with the rank of lieutenant colonel. Thereafter he remained a member of the Ordnance Reserve and until his death continued his active membership in the Army Ordnance Association begun in 1919. ARMY ORDNANCE joins with its entire membership in mourning the loss of one of its most distinguished and affable members.

NOTICE also has been received of the death of the following members of the Association: L. V. Aronson, Newark, N. J.; Maj. Clarence Barnard, Ord. Dept., U. S. Army, San Antonio, Tex.; Allen K. Bucknell, Boston, Mass.; John H. Cavender, Cleveland Heights, Ohio; R. E. Clingan, Chicago, Ill.; George McM. Godley, New York, N. Y.; Walter T. Hazel, Marietta, Ohio; and Charles F. Uebelacker, Hackensack, N. J. To their relatives and friends ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

Ordnance in Review

THE H&R-REISING SUBMACHINE GUN

BY LIEUT. COL. CALVIN GODDARD, ORD. RES.

CURRENT world conditions appear to have created no little interest in a type of weapon which, since the termination of the World War, has, in the United States at least, received but slight attention from the military—namely the submachine gun. Now the picture undergoes a sudden and complete reversal. Combatant nations today seem to find in the submachine gun a weapon of wide usefulness and one they are anxious to acquire in large numbers as speedily as production schedules will permit.

COMPONENTS OF THE NEW SUBMACHINE GUN

A New York exporter recently informed the writer that he could find an outlet for no less than 250,000 to 500,000 such arms among the nations of the British Commonwealth alone could he but secure these within a reasonable time. This figure is in marked contrast with that of some 12,000 to 14,000—the number of Thompson guns reputed to have been made originally by the Colt plant in the early 1920's, the marketing of which occupied somewhat over fifteen years!

Alive to this new and urgent demand, three American makers recently have developed guns of the submachine type, two of these for the popular 9-mm. Luger cartridge and one for the old reliable .45 Colt automatic (for which the Thompson is also chambered). This article will deal with the product of the firm of Harrington & Richardson of Worcester, Mass., manufactured under a patent granted to E. G. Reising, an inventor noted for having designed some years past what was considered by many the best caliber .22 automatic pistol ever to appear in this country. Unfortunately, lack of adequate finances led to the early demise of this piece, but its excellence is attested by the premium figures now commanded by such specimens as occasionally come to light. Thereafter, Mr. Reising developed a .22 rifle of superior characteristics, but again the financial bugaboo arose to inhibit its successful manufacture and distribution.

In his present submachine gun, however, this drawback has been overcome through his affiliation with a firm fully prepared to advance the funds necessary to its development and manufacture. As a result, pilot models of the arm in both semiautomatic and full-automatic forms have been produced and subjected to the most rigorous tests, all of which they appear to have passed with flying colors. Early production of both types now seems to be but a matter of weeks.

The semiautomatic and full-automatic types differ so slightly that the characteristics outlined below will apply to both. In construction they are identical, save for the inclusion in the lock mechanism of the latter of a member which permits the continuous disengagement of the sear when it is set for full-automatic fire, plus the addition of a control button whereby the piece may be set at "safe," "semiautomatic," or "full-automatic." The design is simple and follows the conventional delayed-blowback system, locking being effected by a shoulder encircling the upper portion of the bolt for about half its circumference and abutting, when the piece is closed and ready to fire, a mating recess in the upper inside portion of the receiver. Disengagement of locking surfaces is promoted by milling these at a slight angle to the perpendicular, thus permitting the shoulder on the bolt to slide downward and rearward (*i.e.*, to cam itself out of the locked position) when the force of recoil acts against the face of this member. The accompanying illustration shows the full-automatic type disassembled into its major components.

Cartridges are fed from a 20-shot clip magazine of the Thompson type (the contents being staggered as in that arm); the clip is held in place by a conventional spring latch. Cyclic rate of firing is about 450-500 rounds per minute. Weight approximates 6½ pounds with a barrel length of 11 inches. Muzzle velocity is quoted as 860 feet per second, but since this is the velocity achieved with a barrel but one-half as long as that employed in this piece, such an estimate is evidently on the conservative side. The 230-grain caliber .45 automatic-pistol bullet at the velocity named develops the very considerable energy of 378 foot pounds, with a penetration in white pine of 6 inches at 20 yards. Both these figures are subject to slight augmentation when the additional velocity imparted by the extra barrel length is taken into account.

The stock is of oil-finished American walnut, with pistol grip. Its length is 13¼ inches; drop at heel, 2⅜ inches—at comb, 1⅞ inches. The barrel is of special alloy steel and does not heat quickly as evidenced by the rapid firing of some eighty rounds in the writer's presence, subsequent to which, though hot, it was far from "sizzling." The rear sight embodies a leaf pierced with a central aperture (peep) and mounted on a base which permits of elevations for 50, 100, 200, and 300 yards. The front sight is of the approved (rectangular) post pattern. Sighting radius, despite relatively short barrel length, is 18½ inches—a highly desirable feature.

Accuracy tests have shown this piece capable of delivering a high percentage of its shots into a 10-inch circle at 200 yards—a commendable performance to say the least. An important element promoting this is the fact that, when ready to fire, the bolt is completely closed and locked, and does not slam forward against the cartridge from the unlocked position as in certain other types of submachine weapons. This latter design cannot but set up harmful vibrations materially affecting accuracy when the piece is being fired semiautomatically.

Tests for function of the original pilot model of the full-automatic type had, by October 10, 1940, involved the firing of some 3,470 rounds with but two malfunctions—one due to defective ammunition and one ascribed to incomplete locking of the breech. The conventional "dust test" (the arm being submerged in a box filled with dust and then fired without cleaning) was met successfully, and even after being immersed in a mud bath the piece could still be fired by single loading.

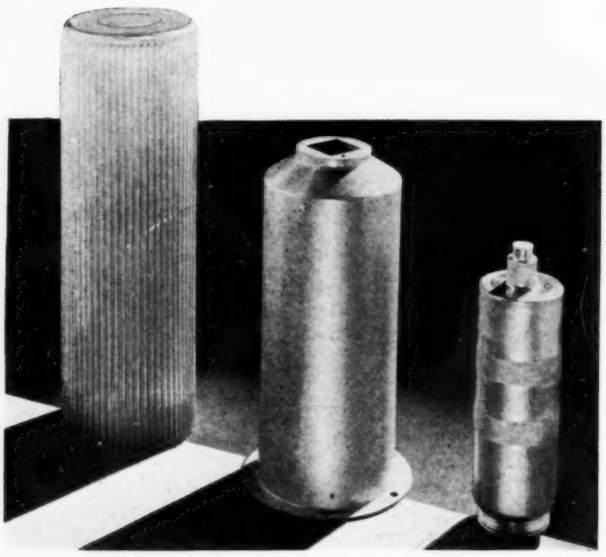
On the occasion of the writer's visit to the plant, the semiautomatic model was the only one available, the full-automatic specimen being out for demonstration. It was therefore impossible to test the makers' claim that the latter piece can be held on the target with almost no effort during the delivery of fully automatic fire, a feature which, if confirmed, will surely enhance the value of this weapon.

In the matter of design, simplicity has been the keynote. Thus there are but three moving parts, and the entire piece may readily be disassembled without tools.

Based on the experience gained from firing two other types of submachine weapons, specimens of both of which are in his collection, the author is convinced that Harrington and Richardson have produced an arm that will play no small part in military events of the future.

Impact Extrusions

GIVE YOU MORE TO START WITH



The pieces pictured above—Alcoa Aluminum impact extrusions—are "raw materials" for three different products. What a head start they give the manufacturers who must meet early shipping dates and keep costs down!

Parts like these, originally designed for other methods of fabrication, can often be altered to take advantage of the more economical impact-extrusion process. They can be quite complicated, eliminating expensive finishing and assembly operations. Walls can be thick or thin. Projections and embossing can be included on bottoms.

With impact extrusions of Alcoa Aluminum Alloys, tolerances are close. The metal is uniform and dependable. Mechanical properties are good. You have all of the other advantages of Aluminum; light weight, resistance to corrosion and fine appearance.

Aluminum Company of America, 2137 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

Ordnance Reserve

Physical Examinations and Waivers for Reserve and National Guard Officers

THE War Department announced recently that the following instructions had been issued regarding physical examinations and waivers for Reserve and National Guard officers ordered to duty with the Army of the United States:

"Information reaching the War Department indicates that in some cases officers of the Reserve components who received two physical examinations by medical boards within the first thirty days after entry upon active duty have been relieved from duty because of findings of the second board that were at variance with findings of the original board for defects that were within the scope of the original board examinations.

"Where a preliminary board of three or more medical officers appointed by proper authority has found an officer physically qualified for extended active duty, the recommendations of any succeeding board will be based solely upon those parts of the second or final-type examination that were not within the scope of the preliminary board examination, such as chest X-ray, electrocardiography, and serological tests. If the first examination was of the final type, no other examination will be required.

"In passing upon the physical qualifications of commissioned officers ordered to active duty, it is desired that reasonable waivers be granted where the interest of the Government or of the military service is not compromised. Corps-area and department commanders, and other reviewing authorities, are authorized to waive physical defects existing at the time of entry upon active duty if such defects will not interfere with the satisfactory performance of field duties appropriate to the grade and assignment of the individual concerned, and if the nature of the defect is such that it is not likely to be aggravated to a disabling degree as a result of active military service.

"Waivers will be granted under this authority only upon the written request of the affected individual, and in the case of National Guard officers, upon the recommendation of the division or separate unit commander concerned. Each request for waiver will be accompanied by an affidavit from the individual acknowledging that the physical defects on which waiver is requested existed prior to entry into active military service, and that they were not the result of such service."

Ordnance School Graduates

THE first class of Ordnance Reserve officers to complete the one month's general refresher course under the new training program was graduated by the Ordnance School at Aberdeen Proving Ground, Md., November 1, 1940.

Brig. Gen. J. B. Rose, commandant of the Ordnance School, presented the students with their certificates of proficiency and the War Department orders assigning them to their new stations. Also present at the exercises were Col. J. S. Hatcher, assistant commandant, Lieut. Col. William I. Wilson, director of officers' division, and Maj. H. J. Conway, executive.

The thirty-three officer graduates, with their new stations, are: Capts. R. J. Bedell, property officer, Detroit Ordnance Plant; F. J. Crossett, unit training center, Raritan Arsenal; G. F. Glass, property officer, St. Louis Ordnance Plant; S. A. Hall, Office, Chief of Ordnance; R. L. Major, property officer, Ravenna Ordnance Plant; P. L. Purvine, Ordnance training center, Aberdeen Proving Ground; C. G. Tolson, property officer, Elwood Ordnance Plant; First Lieuts. F. E. Abrino, property officer, Union Center Ordnance Plant; H. S. Borman, property officer, Kankakee Ordnance Works; S. M. Fletcher, unit training center,

Savanna Ordnance Depot; J. D. Fraser, property officer, Weldon Springs Ordnance Works; A. H. Gardner, property officer, Lake City Ordnance Plant; T. J. Hollenkamp, proof department, Aberdeen Proving Ground; W. C. Leavenworth, Ordnance training center, Aberdeen Proving Ground; M. M. Murphy, Jr., Puerto Rican Department; D. A. Oberst, Erie Ordnance Depot; P. H. Scordas, unit training center, Raritan Arsenal; 2nd Lieuts. S. Camp, property officer, Morgantown Ordnance Works; J. L. Campbell, unit training center, Aberdeen Proving Ground; L. J. Coquet, property officer, Baytown Ordnance Works; J. C. Crumbley, Jr., property officer, Radford Ordnance Plant; H. A. Gerrish, unit training center, Aberdeen Proving Ground; A. B. Hicks, unit training center, Aberdeen Proving Ground; B. J. Hirshorn, Central Indiana Proving Ground; S. O. Hoffman, unit training center, Raritan Arsenal; J. W. Hoover, property officer, Clark Ordnance Plant; C. H. Masters, Erie Ordnance Depot; M. V. Miltiades, Fourth Corps Area (Camp Shelby); L. S. Nelson, Puerto Rican Department; H. M. Randel, unit training center, Savanna Ordnance Depot; G. W. Reitwiesner, proof department, Aberdeen Proving Ground; P. B. Schuppener, unit training center, Savanna Ordnance Depot, and L. M. Showalter, property officer, Radford Ordnance Works.

In addition to the above-named graduates, ten Ordnance Reserve officers undergoing one year of training under the Thomason Act at Aberdeen, were attached to the class and successfully completed the course. Having finished the basic course they will continue on duty for two months as students taking special courses in artillery, small arms, ammunition, and automotive maintenance. The ten Thomason Act officer graduates are: 2nd Lieuts. G. B. Bailey, S. G. Christian, M. C. Foster, B. S. Goodwin, R. G. Kimber, H. V. Mackey, R. V. Mackey, M. Post, S. Sterling, Jr., and J. A. Swint.

STATE GUARDS

ON October 21, 1940, the President signed the State Guard Bill. This bill authorizes States to organize and maintain a State Guard when any part of the National Guard of the State is in the Federal service. This authorization is necessary to comply with Article 1, Section 10, Clause 3 of the Constitution, which provides, "no State shall, without the consent of Congress, keep troops or ships of war in time of peace" and with the National Defense Act of 1916 which limits State military forces to the National Guard.

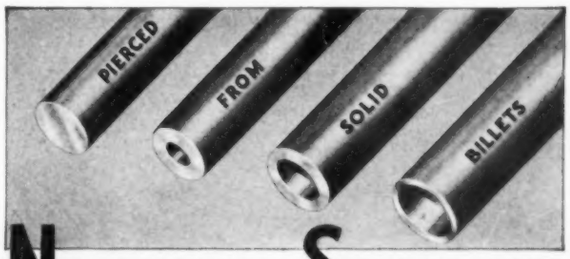
The law provides for some War Department assistance to these State forces in that they are to be organized and maintained under such regulations for discipline in training as the Secretary of War may prescribe and they are to be furnished such arms and equipment as can be spared by the War Department.

The regulations for discipline in training will be so framed as to leave to the state governments the greatest latitude possible in the control of their State Guards. The amount of equipment that can be spared by the War Department is limited but it is believed that the 1917 Enfield rifle and some other small articles of equipment will be available. Uniforms must be furnished by the States.

State Guards will not only be useful to the States for those purposes for which they normally use the National Guard, but, in an emergency, will be of great assistance to the Army. This fact was demonstrated in 1917 when similar organizations were used by the States to guard installations and utilities from sabotage throughout the country. It is estimated that the State forces released the equivalent of three or four divisions of Regular Army troops which thus became available for training and combat.

During the last war, State forces reached a total strength of 79,000 and were in existence in 27 States. At the end of the war they were disbanded and their equipment was returned to the War Department. They had rendered excellent service, greatly assisting our war effort.

H. E. A.



NATIONAL SEAMLESS

America's Preferred Pipe and Tubes

Pierced from solid steel!

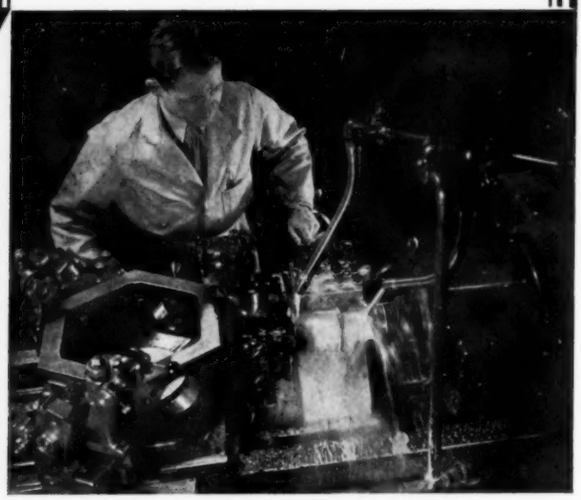
NATIONAL Seamless Pipe and Tubes are pierced from clean, flawless billets of highest quality steel. This material has no longitudinal weld, therefore no line of potential weakness. It is available in sizes ranging from 3/16-inch mechanical tubing to 28-inch O.D. pipe, and in wall thicknesses to meet practically any requirement. Various grades of steel, from plain carbon to the high-alloy grades, can be supplied.

The seamless process is particularly adapted to the production of heavy walled tubing, various types of cylinders, and tubular forgings in a wide range, especially where upsetting, swaging, spinning, or bending operations are to be performed and where a clean, smooth bore or surface finish is highly important. Either as NATIONAL Seamless Pipe or as Shelby Seamless Mechanical Tubing, the identifying emblem, "Walls Without Welds," means—America's Preferred Pipe and Tubes.

NATIONAL TUBE COMPANY
Pittsburgh, Pa.

UNITED STATES STEEL

Steel Gets *"Pickled"* in Sulphuric Acid



Photograph: Courtesy of Atlas Mineral Products Company and B. F. Goodrich Company

Thousands of miles of sheet steel roll out of our mills—sheets unavoidably covered with scale. To make surfaces bright and clean these are "pickled" and the liquid that does the trick is that old standby—sulphuric acid—of which about 980,000 tons were consumed by the American steel industry last year.

Nearly half of all the sulphuric acid produced in the United States is made from Sulphur. Texas Gulf contributes a large portion of this important raw material.

TEXAS GULF SULPHUR CO.
75 E. 45th Street New York City
Mines: Newgulf and Long Point, Texas

Professional Digest

The following items of current information and opinion aim to present a wide range of facts and discussion relating to recent developments of professional military interest. Quotation marks are frequently omitted but sources are indicated.

THE WAR DEPARTMENT HAS TAKEN STEPS TO end a serious bottleneck in the national-defense program by issuing letters of intent to authorize the immediate expansion of facilities for the production of gages by the following concerns: Sheffield Gage Corporation, Dayton, Ohio; Pratt & Whitney Division of Niles-Bement-Pond Company, Hartford, Conn.; Taft-Peirce Manufacturing Co., Woonsocket, R. I., and Greenfield Tap & Die Corporation, Greenfield, Mass. Gages are of the essence of mass production and are necessary to check refinements in the manufacture of munitions parts. The present armament program has greatly increased the need for them both in the production and inspection fields. The step now taken will create additional facilities for their manufacture.

Under the terms of these letters of intent, the four concerns will finance the expansion themselves and will be repaid by the Government over a 5-year period. In the interim, they will rent these added facilities from the Government for the manufacture of gages required by all phases of the armament program. Negotiations dealing with the actual contracts involving awards totaling approximately $3,500,000 are now under way.

NEW PLANTS FOR THE PRODUCTION OF ORDnance continue to be started by the Ordnance Department in rapid succession. The following list of projects with the names of the companies engaged and the approximate cost, supplements that published in the November-December 1940 issue of ARMY ORDNANCE (Vol. XXI, No. 123, p. 280):

At Charlestown, Ind., to E. I. du Pont de Nemours & Company for additional facilities for the manufacture of smokeless powder. The original project announced in July was for $25,000,000. The terms of the new contract are similar to those previously announced. The cost of the additional facilities is estimated at approximately $26,000,000, which brings the total cost of this project to about $51,000,000.

At Wilmington, Ill., to E. I. du Pont de Nemours & Company for additional facilities for the manufacture of TNT, DNT, and tetryl. The original contract ($6,700,000) is increased by $11,060,000 making a total of $17,760,000.

At Lake City, Mo., about twelve miles east of Kansas City, Mo., to the Remington Arms Company, Inc., of Bridgeport, Conn., for the procurement of equipment and the operation of a small-arms ammunition plant. The establishment will be known as the Lake City Ordnance Plant. The contract totals $73,575,261. Of this, approximately $12,600,000 will be for the purchase of equipment and $59,000,000 will be for the manufacture of small-arms ammunition. Agents selected by the Quartermaster Corps of the Army are now in process of purchasing approximately 2,200 acres of land for the Government upon which the plant will be erected.

At Baytown, Tex., to the Humble Oil & Refining Company of Houston, Tex., for facilities for the manufacture of toluol. The principal provisions of the contract are as follows: (a) For the construction of a new plant close to the present site of the existing Humble plant, to be known as the Baytown Ordnance Works—$10,760,000; (b) For additional equipment in the existing Humble plant—$1,097,000.

At Weldon Springs, Mo., to the Atlas Powder Company of

Wilmington, Del., for the operation of the TNT plant at Weldon Springs, near St. Charles, Mo. The contract totals $6,390,000. The Fraser-Brace Engineering Company, Inc., of New York, N. Y., will erect the plant at an estimated cost of approximately $11,325,000. The plant will be owned by the Government.

At Radford, Va., for additional facilities totaling approximately $10,000,000, to the Hercules Powder Company. The original project for a smokeless-powder plant at Radford at an approximate cost of $25,000,000 was announced during August. This addition brings the total cost of this plant to about $35,000,000 and will increase the contemplated production by approximately fifty per cent above the output originally planned.

At West Homestead, Pa., to the Mesta Machine Company of Pittsburgh, for equipping a gun-tube factory. The company will construct and own the building. The equipment will be installed at a cost of approximately $1,680,000. Title to the equipment will remain with the Government.

At Hartford, Conn., to the Colt's Patent Fire Arms Manufacturing Company for the installation, in buildings owned by that company, of increased equipment for the manufacture of infantry weapons totaling $8,074,406. Title for the equipment will remain with the Government.

At Burlington, Iowa, to Day & Zimmerman, Inc., of Philadelphia, $34,451,384 for the design, supervision of construction, installation of equipment, and operation of a shell-loading plant located near Burlington, Iowa. Approximately 20,000 acres of land are being acquired for the Government.

At Union Center, Ind., to Todd & Brown, Inc., of New York, N. Y., for the operation of a shell-loading plant at an estimated cost of $26,800,000. The plant will be constructed by the Bates & Rogers Construction Company of Chicago, at an estimated cost of $11,500,000. Both contracts will be on a cost-plus-fixed-fee basis.

A PROCEDURE HAS BEEN WORKED OUT JOINTLY by the National Defense Advisory Commission and the War, Navy, and Treasury Departments to handle applications from manufacturers for certification required by the amortization section of the new tax law. This law provides that manufacturers, in certain cases, may use an accelerated rate of depreciation for income and excess-profits tax purposes on plants or equipment certified as necessary in the interest of national defense during the emergency period. Specifically, a manufacturer who constructed or acquired new facilities after June 10, 1940, may, in determining his taxes, amortize the cost of such facilities over a 5-year period instead of the normal period of depreciation of such property if he receives a "necessity certificate."

When a manufacturer is being reimbursed by the Government for the cost of his new facilities at a rate exceeding normal depreciation, either directly or indirectly, the manufacturer will be required to obtain a "certificate of Government protection," stating that the contract adequately protects the Government with reference to future use and disposition of the facilities involved. If the manufacturer is not being thus reimbursed he may obtain a "certificate of nonreimbursement" to that effect which will conclusively establish for the purposes of the tax law that a "certificate of Government protection" is not required.

All three certificates require the approval of the Defense Commission and of either the Secretary of War or the Secretary of Navy. Certification is to be made to the Commissioner of Internal Revenue. Instructions covering the information required on applications for these certificates may be obtained from the Office of the Assistant Secretary of War or the Office of the Judge Advocate General of the Navy. Instructions also are being forwarded to War Department district procurement officers and will be available to applicants at these offices. In announcing joint approval of this procedure, Donald M. Nelson, Coördinator of National Defense Purchases, said: "Completion of the procedure for obtaining rapid depreciation of facilities

MILITARY VEHICLES
OF ALL TYPES

COMBAT TANKS • ARMORED CARS
SCOUT CARS • RECONNAISSANCE CARS
OFFICERS CARS • AMBULANCES
MOBILE MACHINE SHOPS
ARTILLERY TRACTORS for Guns of All Sizes
HIGH SPEED TRACK LAYING ARTILLERY TRACTORS
CAPTIVE BALLOON WINCHES
AIR FIELD SERVICE TRACTORS
AIRPLANE CRASH TRUCKS • FIRE EQUIPMENT
AIRPLANE WRECKING TRUCKS
MOBILE AIRCRAFT MACHINE SHOPS
MOBILE OXYGEN GENERATOR UNITS
MOBILE WATER PURIFICATION UNITS
AIR FIELD ROTARY SNOW REMOVAL EQUIPMENT
AIR FIELD FUEL SERVICING TRUCKS

We are Specialists in the Design and Production of Military Transportation Equipment

MARMON-HERRINGTON CO., INC.
MANUFACTURERS OF ALL-WHEEL-DRIVE VEHICLES AND HIGH SPEED TRACK LAYING VEHICLES
INDIANAPOLIS, INDIANA, U. S. A.
Purveyors to U. S. Army, U. S. Navy, U. S. Marine Corps and Many Foreign Governments

constructed to meet the requirements of the defense program should materially benefit and expedite the armament effort. The solution of this difficult problem has been accomplished through the coöperation of all agencies connected with the defense program and the National Defense Commission."

THE BILL (S. 4370) AUTHORIZING THE PRESIDENT to appoint an Under Secretary of War during national emergencies, fixing the compensation, and authorizing the Secretary of War to prescribe duties, has been passed by the House. There was objection raised to that part of the wording of the bill which seemed to place the Congress in the position of approving the limited national emergency declared by the President. A national emergency has not been declared by the Congress and members insisted it must not be done by indirection. The bill was amended to limit the office to January 20, 1945 (expiration of the draft law), unless continued in force by an act of Congress. The Under Secretary of War will rank next after the Secretary of War and will be paid $10,000 per annum.

A MACHINE TOOL PRIORITY COMMITTEE TO COordinate national-defense, commercial, and export demands on the machine-tool industry has been announced by the Priorities Board of the National Defense Advisory Commission. The committee, composed of representatives of the industry, the Army, the Navy, and the Commission, will formulate policies governing operation of the voluntary preference rating system, now in effect, as it applies to machine-tool contracts. Mason Britton, assistant director of the Machine Tools and Heavy Ordnance Division of the Defense Commission, has been appointed administrative officer of the committee. Mr. Britton, working under the direction of Donald M. Nelson, administrator of priorities, will carry out policies formulated by the committee and approved by the board. He will handle all pertinent cases that may arise and will maintain the necessary contacts with industry and with Government departments.

The committee will not be concerned with questions of precedence between various national-defense contracts placed by the Army and Navy. This function will remain in the hands of the priorities committee of the Army and Navy Munitions Board.

Members of the Machine Tool Priority Committee are: Mr. Britton, administrative officer; Clayton R. Burt, president of the Pratt & Whitney Division, Niles-Bement-Pond Company, and chairman of the Machine Tool Builders Defense Committee; Frederick Geier, president of the Cincinnati Milling Machine Company; Lieut. Col. A. B. Johnson, chief of the machine-tool committee of the Army and Navy Munitions Board, representing the Army; Comdr. E. R. Henning, member of the machine-tool committee of the Army and Navy Munitions Board, representing the Navy.

COL. RUSSELL L. MAXWELL, ADMINISTRATOR OF Export Control, and former editor of ARMY ORDNANCE, announced recently the establishment of a compensation board, organized for the purpose of considering the fair and just compensation to be paid for articles or materials requisitioned under Public 829, Seventy-sixth Congress. This act, approved by the President October 10, 1940, permits the requisitioning of articles or materials vitally needed for the national defense which are physically available in this country and the exportation of which has been denied but because of contractual obligations or title transferal to foreign holders cannot be released for use in the domestic rearmament program.

The compensation board, whose chairman is Brig. Gen. Edwin D. Bricker, former Assistant to the Chief of Ordnance, will hear all evidence relating to the financial aspects of each requisitioning case, and make recommendations to the Administrator of Export Control as to the proper amount due the owners of the requisitioned articles or materials.

Colonel Maxwell announced that the board consists of the

following officers in addition to General Bricker: Col. Henry W. Eglin, U. S. Army, Ret., formerly secretary of the Army and Navy Munitions Board; Col. Francis R. Kerr, Inf. Res., secretary of the board, now on extended leave as deputy director of Civil Service for the State of Rhode Island; Lieut. Col. Charles N. Trammell, J.A.G.D. Res., member of the Bar of the District of Columbia.

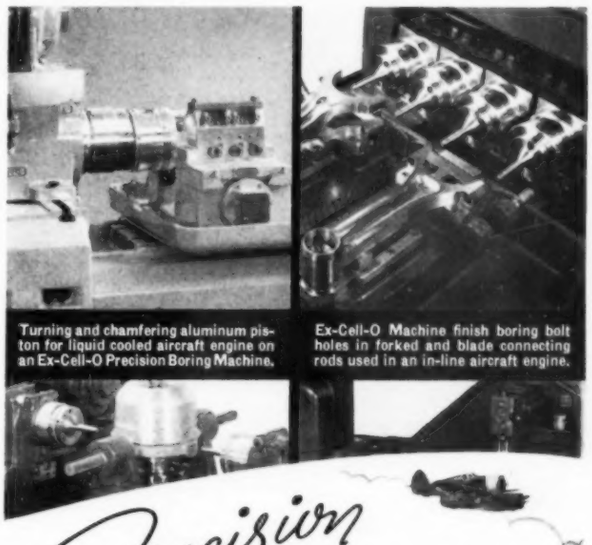
UNDER PRESENT PLANS OF THE WAR DEPARTment two new armored divisions will be formed in June 1941. At the present time the Armored Force of the United States Army consists of one armored corps of two divisions with headquarters at Fort Knox, Ky., Maj. Gen. Adna R. Chaffee commanding. One armored division is located at Fort Knox and the other at Fort Benning, Ga. The present Armored Force is to be increased in strength temporarily in order that training cadres for the new divisions may be available. Approximately 5,000 additional men are to be assigned to the existing forces at Fort Benning and Fort Knox during January 1941. These men will be trained either with their respective divisions or at the Armored Force replacement center being established at Fort Knox.

It is planned to assign approximately 9,000 men from selectees inducted into the service after March 15, 1941, and training cadres consisting of approximately 2,500 men to each of these new divisions. It is contemplated that one of the new armored divisions will be stationed in a cantonment to be located in Pine Camp, N. Y., and the other in the vicinity of Camp Beauregard, La.

A TRACT OF MORE THAN 1,500,000 ACRES OF FEDerally owned range land in Utah has been acquired as an Air Corps bombing range. This and other bombing-range sites now under consideration in the western part of the United States will be used for gunnery and bombing practice by Air Corps units stationed along the Pacific Coast and in other parts of the West and Southwest. The area will be known as the Wendover bombing range, after Wendover, Utah, the principal town near the area. Embracing parts of Box Elder, Tooele and Juab Counties, Utah, it is approximately eighty-six miles long.

Salt flats and desert stretches comprise much of the area, which is included within the boundaries of Utah Grazing Districts Nos. 1 and 2, administered by the Grazing Service, Department of the Interior. Officials of the Department of the Interior coöperated with the War Department in securing its use as a bombing range. The area has been used in the past during the winter months to graze approximately 20,000 sheep and 300 cattle. This livestock will be absorbed in other grazing districts when the Army takes physical possession of the land in the near future. No construction of any type is contemplated for the new bombing range The nearest Air Corps units are the 20th Wing Headquarters the 7th Bombardment Group, and the 5th Air Base Group at Salt Lake City, Utah, the 42nd Bombardment Group at Boise, Idaho, and the Ogden Air Depot at Ogden, Utah.

THE WAR DEPARTMENT HAS ADOPTED FOR THE Army's aviation objective for training and organization 12,800 airplanes of all classes and types; an increase in all enlisted personnel for duty with the Air Corps from 45,000 to 163,000 including an increase in annual output of trained pilots from 7,000 to 12,000; an increase in Air Corps technical schools and instructors to provide the many skilled mechanics and other specialists required to maintain and operate the modern fighting airplane; and the acquisition of many new stations for new combat groups, to be activated as the personnel and matériel for them become available. The figure of 12,800 airplanes of all classes and types refers only to those tactical planes required to equip the 54 combat groups (plus a small reserve) and to those required for basic and advanced flying training purposes, and is included in the approximately 18,000 planes already contracted for or received, the remainder of which constitute a reserve.


Turning and chamfering aluminum piston for liquid cooled aircraft engine on an Ex-Cell-O Precision Boring Machine.

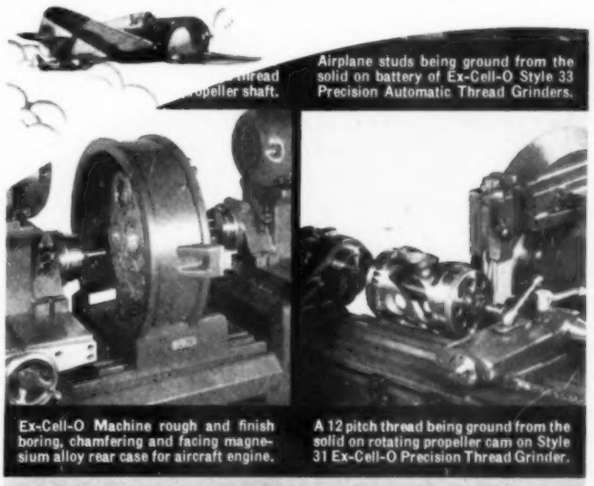
Ex-Cell-O Machine finish boring bolt holes in forked and blade connecting rods used in an in-line aircraft engine.

Precision ...COMES INTO ITS OWN!

An Ex-Cell-O Precision Machine represents a basic requirement of modern industry—*extreme accuracy in measurement.* Without exceedingly fine measurements—as available with every Ex-Cell-O machine—and the interchangeability of parts that such precision allows, today's mass production would be impossible . . . the speed on which success of the nation's defense program depends could not be attained.

Ex-Cell-O is a pioneer in developing higher standards of precision performance with machine tools. This is why today—in quantity production of precision metal parts—Ex-Cell-O Precision Machines and Tools are entering so vitally into armament plans.

EX-CELL-O CORPORATION, 1216 Oakman Blvd., Detroit, Mich.


...thread ...propeller shaft.

Airplane studs being ground from the solid on battery of Ex-Cell-O Style 33 Precision Automatic Thread Grinders.

Ex-Cell-O Machine rough and finish boring, chamfering and facing magnesium alloy rear case for aircraft engine.

A 12 pitch thread being ground from the solid on rotating propeller cam on Style 31 Ex-Cell-O Precision Thread Grinder.

XLO *Precision* THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, GRINDING SPINDLES, HYDRAULIC POWER UNITS, DIESEL INJECTOR PUMPS, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, ETC.

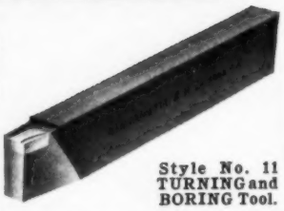
KENNAMETAL

SETS NEW PERFORMANCE RECORDS

in **TURNING BORING SHAPING**

and **MILLING ARMAMENTS**

TURNING SHELLS



Style No. 11 TURNING and BORING Tool.

Operation: Rough turning 75-mm. shells.

Material: X1335 drop forging.

Speed: 196 ft./min.

Performance: 40 seconds' machining time. One minute floor to floor time. 2¾ lbs. of metal removed per minute, 200 pieces per grind of tool.

BORING AIRPLANE STRUTS

Operation: Roughing and finishing airplane struts.

Material: SAE 4150 heat-treated forgings. Hardness—402 Brinell.

Speed: Roughing—125 ft./min. Finishing—150 ft./min.

Performance: High-speed steel was unable to machine this material. Another carbide cutting material failed completely. KENNAMETAL performed satisfactorily in every way.

SHAPING ARMOR PLATE

Style No. 20 SHAPER Tool.

Operation: Remove 5/32" from 1" x 18" x 18" Armor Plate.

Material: Cast alloy steel with extreme hard spots and sand pockets. Hardness—42 Rockwell C.

Speed: 60 ft./min. as compared to 11 ft./min. for high-speed steel.

Performance: KENNAMETAL averaged 31" between tool grinds as compared to 8" per grind for high-speed steel. There was no cratering or chipping of the KENNAMETAL tip.

MILLING AIRPLANE PARTS

Operation: Milling aluminum airplane parts.

Tool: 3½" milling cutter tipped with KENNAMETAL grade KH.

Speed: 1,800 r.p.m. or about 1,600 ft./min.

Performance: The cutter has been in use every day for four months without being sharpened.

If you manufacture armaments or other equipment for National Defense, KENNAMETAL-tipped tools will greatly reduce machining time on your steel parts—regardless of the operation. Write for complete information—today.

IMPORTANT NOTICE:

KENNAMETAL tools cost no more than ordinary carbide tools—see our new price schedule.

SHELL END MILL with KENNAMETAL-tipped blades.

McKENNA METALS Co.

331 LLOYD AVENUE

LATROBE, PENNSYLVANIA, U.S.A.

THREE NOTABLE GRADUATION EXERCISES AT the Ordnance School, Aberdeen Proving Ground, Md., were held in recent weeks. They included three separate classes, one of Regular commissioned officers, another of Regular noncommissioned officers and a third of Reserve officers. An account of the graduation of Reserve officers is published on page 382 of this issue.

The Regular officers' class of the Ordnance School was graduated September 27, 1940. Brig. Gen. J. B. Rose, commandant of the school, made the graduation address and awarded the diplomas. On the platform with General Rose were Col. J. S. Hatcher, assistant commandant; Lieut. Col. G. W. Outland, director of enlisted courses; Lieut. Col. W. I. Wilson, director of the officers' courses; Maj. H. J. Conway, executive officer, and Capt. E. H. Kibler, instructor.

Members of the graduating class and new station assignments are as follows:

GHQ Air Force, Langley Field, Va.: Capts. Peter B. Bernd, Harvey Bower, F. O. Bothwell, W. F. Meany, E. W. Miles, J. R. Dickson, A. B. Robbins, Jr., 1st Lieut. R. E. Sims. Armored Force, Fort Knox, Ky.: Capts. F. G. Pratt, R. G. Baker, C. H. Wood, F. G. Crabb, Jr. Second Armored Division, Fort Benning, Ga.: Capts. J. L. Cowhey, J. P. Sherden, Jr. Antiaircraft Artillery Firing Center, Fort Bliss, Tex.: Capt. E. J. Gibson. Massachusetts Military Reservation, Falmouth, Mass.: Capt. S. W. Connelly. Antiaircraft Firing Center, Camp Hulen, Tex.: Capt. E. N. Kirsten. March Field, Calif.: Capt. O. G. Kreiser. Office, Chief of Ordnance, Washington, D. C.: Capt. M. L. DeGuire, 1st Lieut. W. Menoher. Ordnance School, Aberdeen Proving Ground, Md.: Capts. A. V. Dishman, G. C. Carlson. Aberdeen Proving Ground: Capts. A. W. Manlove, H. G. Davisson. Puerto Rico: Capts. E. G. Robbins, Jr., E. D. Mohlere. Panama: Capt. J. S. Luckett. Hawaii: Capt. J. L. McGehee, 1st Lieut. R. B. Anderson. Ordnance School, Raritan Arsenal, N. J.: Capt. P. H. Brown, Jr. Rock Island Arsenal, Rock Island, Ill.: Capt. H. J. Katz. Picatinny Arsenal, Dover, N. J.: Capt. J. S. Brierley.

The school at Aberdeen graduated, October 18, 1940, the largest class of noncommissioned officers to attend that institution since the World War. This represents the first of a number of classes being selected for training, preparatory to being promoted to staff sergeants in the Ordnance Department, 190 of this class having been graduated as staff sergeants.

The Ordnance School, located at the Aberdeen Proving Ground, the center of ordnance proof and development activities, has moved into its new group of stone buildings that are rapidly nearing completion. The temporary construction now under way in the area surrounding this imposing group of buildings will eventually provide training facilities for approximately 10,000 men.

The training program includes courses of instruction for officers, N.C.O.'s and specialists. Enlisted men of all branches of the service who are qualified for training in ordnance activities may make applications for courses in accordance with existing regulations. Beginning February 1, 1941, new classes will start every two weeks. This personnel will be trained for duty largely with newly formed organizations.

GENERALLY SPEAKING, THE ARMY'S TRAINING publications are now issued in the form of Field Service Regulations, field manuals and technical manuals. The manual project is gradually eliminating other training publications such as technical regulations, training manuals, and training regulations. It is doing this by including material from them in the other training documents in order to reduce substantially the number of types of publications.

Field Service Regulations, the most important of all Army training literature, "constitute the basis of instruction of all arms and services in the operations of war and announce the basic doctrines which are expanded and applied to other texts." Field

manuals constitute the primary means for expanding the basic doctrines of the Field Service Regulations. Technical manuals consist of a series of pamphlets supplementing the field manuals and covering subjects, the separate treatment of which is considered essential to the fuller accomplishment of the training prescribed in the field-manual series. This series includes pamphlets describing matériel and containing instructions for the operation, care, and handling thereof, guidebooks for instructors and specialists, material for extension courses, reference books, source material data and the like.

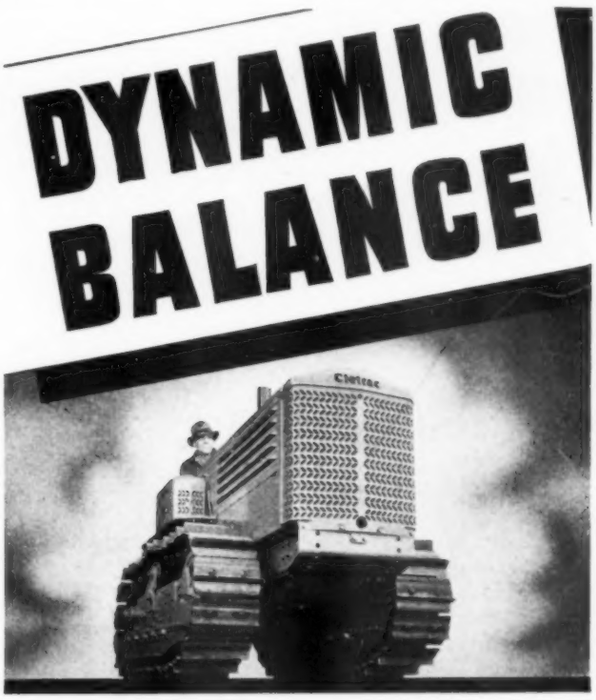
The present European war has confirmed the fundamental doctrines enunciated in our Field Service Regulations. There has been some change in methods of operation because of lessons learned from the war and the introduction of new weapons. Besides keeping the basic manuals up to date, the project also performs several other extremely useful functions. It undertakes the preparation of certain manuals for special operations, such as winter training, mountain training, jungle warfare training, traffic control in civilian areas during war, etc. In addition, much has been done by the project to improve the legibility of all manuals, especially as an aid for the busy National Guard and Reserve officers.

THE USE OF SABERS BY OFFICERS ON DUTY WITH troops and the training or instruction in the use of sabers by officers will be discontinued during the present emergency. At the same time the War Department ordered that the Sam Browne belt will be worn only on those occasions when the service coat or blouse is worn and arms are not carried by officers. Local commanders are authorized to dispense with the carrying of arms by officers at ceremonies. When the pistol is carried by an officer wearing the service coat or blouse or olive drab shirt, it was further ordered, the officer's web pistol belt will be worn. The War Department also has published an order stipulating that during the present emergency officers who do not possess sabers will not be required to purchase them.

A SHIPBUILDING STABILIZATION COMMITTEE TO explore ways and means of stabilizing employment in the country's shipyards has been appointed by Sidney Hillman, commissioner in charge of the Labor Division of the National Defense Advisory Commission. The committee is composed of representatives of organized labor, the shipbuilding industry, the Navy, and the Maritime Commission. Morris L. Cooke, industrial engineering consultant attached to the staff of the Labor Division, has been named chairman.

The committee is expected to undertake a detailed investigation of wage rates and working conditions, with particular emphasis upon the migration of workers from yard to yard and its effect upon production. The inquiry will cover the various shipyard "zones" throughout the nation and will form a basis for recommendations to the National Defense Advisory Commission as to a labor program that can best insure the most efficient construction of ships vitally needed for national defense. A committee similar in personnel and purpose will soon be set up for the aircraft industry and possibly for other industries which are closely associated with national defense.

The Shipbuilding Stabilization Committee consists of the following: Harvey Brown, president, International Association of Machinists; John P. Frey, president, Metal Trades Department, American Federation of Labor; John Green, president, Industrial Union of Marine and Shipbuilding Workers of America; Gregory Harrison, representing Pacific Coast shipyards; Adm. Emory S. Land, chairman, U. S. Maritime Commission; F. A. Liddell, representing Gulf Coast shipyards; Joseph W. Powell, special assistant to the Secretary of the Navy, representing the Navy; Prof. H. L. Seward, representing North and South Atlantic Coast shipyards; H. Gerrish Smith, representing Great Lakes shipyards, and Philip H. Van Gelder, secretary, Industrial Union of Marine and Shipbuilding Workers.



No Power Loss
ON TURNS

Through the perfection of an ingenious but simple method of gearing, CLETRAC engineers have made it possible for CLETRAC crawler tractors to make turns without having the power disconnected on one track and forced on the other track! Each track gets its full share of engine power by means of this *exclusive differential steering* method. Perfect safety and control is assured when going down-grade with the tractor coasting, and the load pushing. BUILT TO ENDURE, CLETRAC gives longer DEPENDABLE tractor life.

THE CLEVELAND TRACTOR CO.
CLEVELAND, OHIO

Cletrac
Crawler Tractors

INDIAN FIRE PUMPS
Will Enable These Men
TO PUT THE FIRE OUT IN A JIFFY

BUT IT CAN SPREAD INTO A SERIOUS BLAZE IF THEY HAVE TO DO THIS!

Photos by U. S. Forest Service

FIRE

is an ever-present hazard in military areas. Gun practice may cause grass and brush fires. Camp buildings and tents need protection. INDIANS give that protection. Simply keep filled with clear water. To operate, work handle back and forth pumping powerful, continuous stream. Five-gallon tank carries by hand or slung on back. A compact unit for fighting all fires. *Catalog on request.*

INDIAN FIRE PUMPS ARE USED AND ENDORSED BY CCC CAMPS, THE U. S. FOREST SERVICE, AND MANY OTHER STATE AND FEDERAL DEPARTMENTS.

Use Only Clear Water

Can be made non-freezing to 40 below zero. Extra strong, quality construction. Large filler opening. Air conditioned—no moisture reaches the back. Thousands in use.

Fully guaranteed by

D. B. SMITH & CO. UTICA, N.Y.

PACIFIC COAST AGENTS:

Hercules Equipment & Rubber Co., 550 3rd St., San Francisco, Calif.
Western Loggers' Machinery Co., 302 S. W. 4th St., Portland, Oreg.
Mill and Mine Supply, Inc., 2700 4th Ave. S., Seattle, Wash.
Roy G. Davis Company, 617 E. 3rd St., Los Angeles, Calif.

Book Reviews

A HISTORY OF THE COLT REVOLVER. By Charles T. Haven and Frank A. Belden. New York: Wm. Morrow & Company. 711 pp. $10.

THE American small-arms collector is a peculiar beast. After the mania has him fully in its grasp, and he has passed through the preliminary stages of acquiring without rhyme or reason anything which embodies a lock, stock, and barrel, he often becomes highly selective and bends all his energy toward the accumulation of the product of some one maker. In the field of the handgun, this maker proves, in nine cases out of ten, to be Samuel Colt and those who have followed him in the fabrication of arms that bear his name.

Prior to the appearance of the volume now under review, all too little information upon weapons of Colt manufacture was available. Most contributions to the literature concerned exclusively the *use* of the pistol and revolver in sport and war, rather than detailed accounts of the offerings of the various makers. One was forced to glean a bit here and there and piece together as best he might. True, the sources have been numerous. Commencing with Gould (1838 and 1894), there have appeared (in the U. S. A.) works on pistols and revolvers by Winans (1901 and 1919), Himmelwright (1908 and 1928), Sawyer (1911), Pollard (1911, 1920, and 1926—the last a general history of firearms), Hatcher (1927 and 1935), Frazier (1929), Fitz-Gerald (1930), Hitchings (1931), Reichenbach (1936 and 1937), Gluckman (1939), and Fischer (1940).

But from all these together it would be impossible to construct any but the most fragmentary account of the evolution of the Colt revolver and automatic pistol (not to mention the less widely known products of the Colt factory). Indeed, the most ambitious efforts toward such an end will be found in Satterlee's "Catalog of Firearms for the Collector" (1927 and 1939) and the official Colt publication "A Century of Achievement" (1937). Both of these carry fairly complete listings of the products of the Colt plant up to their respective dates of publication. But in the former work, Colt arms constitute but one of hundreds of makes described and illustrated, so that space limitations render impossible the comprehensive discussion of any one model, while in the latter, only about twenty-five per cent of its modest ninety-seven pages concern other than current offerings. More helpful data on the historical side are to be found in Rohan's biography of Samuel Colt ("Yankee Arms Maker," 1935), but this was written for the general public—not for the gun enthusiast.

And so the fraternity of American arms collectors has long and impatiently awaited a work on its favorite weapon. Many such have been planned, but prior to the publication of the present offering, all have died aborning. Apparently the Colt Company finally realized that if a complete and authoritative account of its history and products ever was to see the light, it must become a party to the effort. Once so convinced, it put its shoulder to the wheel in no uncertain fashion. The result is the magnificent volume now available.

This 711-page quarto contribution by Messrs. Haven and Belden will long serve as the standard reference source on anything pertaining to Samuel Colt and the great plant which today stands as a monument to the ingenuity, energy, and resourcefulness of that remarkable individual. Its authors have taken great pains to consult all available source material—some of which fortunately came to light, thanks to the researches of Maj. James E. Hicks, while their book was nearing completion. They have inspected and photographed specimens of Colt arms in many of

the more important existing collections, and have consulted with an imposing array of recognized authorities on Colt history and Colt products. The result is a work which everywhere gives evidence of having been compiled with the exacting care of the trained researcher rather than being the product of authors who have written "something to sell."

Even so, one notes an occasional omission and, in one instance, what appears to be wilfull rejection of a golden opportunity to lay the ghost of a long and bitter polemic. This concerns probably the only point in the history of Colt weapons which remains the subject of acrimonious discussion and one which appears to have engaged the interest of every Colt collector since the memory of man runneth not to the contrary—to wit, the date of the origin of the first so-called "Walker" model, named for the famous Captain Walker of the Texas Rangers. Majority opinion, which Messrs. Belden and Walker accept, holds that this did not appear until after the closure of the original Colt factory in Paterson, N. J. (1842), but prior to the establishment of the Hartford works (1847). There exist, however, four Walker-type specimens, acquired some three years past by a New England collector which, if authentic and stemming from the dates ascribed to them by their present owner (and others), are definitely of Paterson fabrication. The price said to have been paid for these (nearly $2,000 each) is sufficient evidence of the fact that the purchaser, at least, was convinced of their genuineness and of the time and place of their manufacture. In substantiation of his opinion, he published (1937) a 25-page monograph, perusal of which will convince the reader that the author has advanced arguments in favor of his theory (*i.e.*, of the production of these pieces at Paterson) which are at worst ingenious and at best—unanswerable. Yet these are dismissed in the present volume with the following paragraph (p. 53):

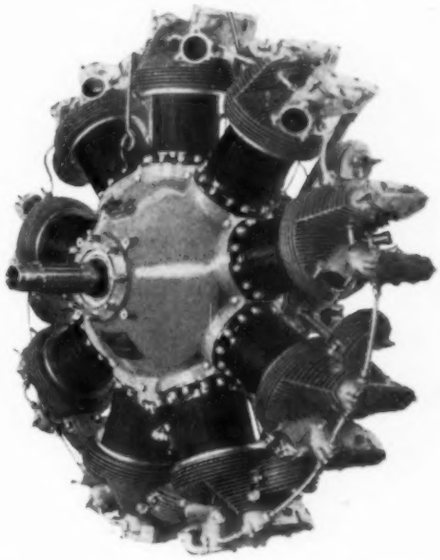
"A group of curious arms of the WALKER type, some of them marked COLONEL COLT, and LONDON, and others with PATERSON marks, have recently been written of in an interesting pamphlet. The arms seem difficult to account for in view of any contemporary documents that we have been able to have access to. However, *we have not examined the arms personally*, so we cannot presume to pass judgment on them" (Italics ours).

Judgment is passed, however, and that in no uncertain manner, when Haven and Belden embrace, as they do most definitely, the idea of the non-manufacture at Paterson of any arms of the Walker type. Yet here were four pivotal weapons located not over a few hours motor run from Hartford and presumably available for study, for if unavailable it is reasonable to suppose that this fact would have been mentioned. Why were they not examined?

With regard to the omissions previously referred to, none of these is serious, yet it is regrettable that *any* should exist in a work otherwise so comprehensive and so laboriously compiled. Thus we learn that the double-action "Lightning" model revolver was made in .38 and .41 center-fire calibers. (In the latter size it was sometimes advertised as the "Thunderer," but I find no reference to that fact in the present work.) This is true, but it is also true that this model was produced in .32 Colt short and long center-fire caliber as well, this reviewer (who is not a Colt collector) having owned two such, both unquestionably unaltered specimens just as issued by the factory. Again, no mention is made of a .45 double-action army model in *"flat-top target"* form. This reviewer has owned such a piece also, the authenticity of which was beyond question.

Although the illustrations are excellent and copious, several of the same model being included in many instances, it is to be regretted that there appears none of the early .45 automatic *with grip safety;* of the variant of the caliber .42 Berdan rifle, a considerable number of which were produced for target purposes; of the .45-70 double-barreled hammer rifle, a few of which were manufactured (good specimens now command prices which compare favorably with those offered for some of the

Guiberson Diesel
MODEL A-1020
310 H.P. at 2150 R.P.M.
C.A.A.—A.T.C. No. 220



Guiberson Diesel Engine Company
Manufacturers of Diesel Aircraft Engines
DALLAS, TEXAS CHICAGO, ILLINOIS

AMERICAN STEEL FOUNDRIES

Manufacturers of
ALLOY and CARBON
Steel Castings
Forgings
Springs

★

RAILWAY INDUSTRIAL ORDNANCE

★

MALLEABLE IRON CASTINGS

★

Principal Office—Chicago, Ill.

PLANTS
Verona, Pa.; McKees Rocks, Pa.
East Chicago, Ind.; Hammond, Ind.
East St. Louis, Ill.; Granite City, Ill.
Galesburg, Ill.; Alliance, Ohio
American Steel Castings Co., Newark, N. J.

NO OTHER MACHINE CAN DO THIS

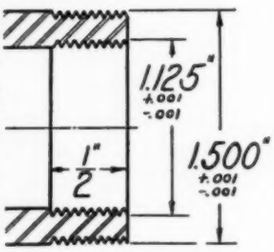
—Mill an Internal Left-Hand Thread and an External Right-Hand Thread Simultaneously. . . .

These Double-Threaded Cold Rolled Steel parts are finished at from two to three pieces per minute—and the threads are Absolutely Concentric.

This is a threading job that "Can't Be Done"—but

THE HALL PLANETARY DOES IT!

The "Universal Thread Master" through a combination of gearing, produces 40 pitches or more, right- or left-hand, straight or taper threads, through a standard 10-pitch master nut by employing the differential screw principle.



Write for complete details.

THE HALL PLANETARY COMPANY
Fox Street and Abbotsford Avenue
PHILADELPHIA, PA.

GEARED
to meet the Urgent demands
OF YOUR PRODUCTION LINE

Consider these points when you look for a dependable source of spring parts:

INTELLIGENT HANDLING OF SPECIFICATIONS
PROMPT, CERTAIN ACTION IN TOOLING UP
DELIVERIES TO MEET YOUR PRODUCTION
UNIFORM QUALITY FROM START TO FINISH
ONE SOURCE OF SUPPLY FOR MANY PRODUCTS
EFFICIENT PLANNING FOR GREATEST ECONOMY

Controlled quality from steel to finished part is Barnes' answer to the day's demand for production and still more production. A modern steel mill owned and operated by Barnes is capable of producing stock for almost any requirement, every day. Large amounts are always on hand for quick conversion into the kind of spring you need.

The Wallace Barnes Company . BRISTOL, CONNECTICUT
DIVISION OF ASSOCIATED SPRING CORPORATION
SPRINGMAKERS FOR MORE THAN THREE QUARTERS OF A CENTURY

Barnes-made SPRINGS

rarest of the revolver types ever to issue from the Colt plant); or of the .45 double-action army revolver with short barrel and no ejector, though an illustration of the comparable *single* action army model does appear.

The present volume is divided into four parts plus a 4-page glossary, and an index. The first part comprises 18 chapters, totaling 240 pages. Chapter I is devoted to a brief history of hand firearms. Chapter II discusses early (pre-Paterson) model arms of experimental and promotional types, and Chapter III, the regular products of the Paterson factory (1836-1842). In Chapter IV we find the much-discussed Walker model and the history of Colt and his products in the interval between the closure of the Paterson plant and the opening of the first modest works on Pearl Street, Hartford, in 1847. (One thousand specimens of the Walker model were produced by Eli Whitney, inventor of the cotton gin, in his factory at Whitneyville, Conn., under a contract between Colt and himself dated January 4, 1847.) The remaining chapters of Part One carry the evolution of the Colt revolver, rifle, shotgun, ammunition, and accessories (bullet molds, powder flasks, etc.) from 1847 to the present.

In Part Two (pp. 243-247) we find 10 pages taken up with an enumeration of now obsolete models constituting a handy reference index of these. Part Three (pp. 251-540) is introduced by a reproduction of a broadside employed by Colt when he was demonstrating the effects of nitrous oxide in those early days when he was struggling to acquire the funds to follow his natural bent toward the development of arms and explosives. Dated at Portland, Maine, October 13, 1832, it constitutes an interesting historical item. There follow "A Number of Documents Contemporaneous to the Manufacture of Colt Arms from 1832 to 1940," including a fascinating assembly of advertising matter from 1838 onward, descriptions and illustrations of the Colt plant at various stages of its history, Government correspondence on Colt products, etc.

Part Four (pp. 541-695) offers facsimiles of an assortment of patents issued on Colt weapons commencing with the original revolver patent of 1836 and ending with that of a magazine rifle in 1883. One speculates why they end at this point. Perhaps the dictates of expediency indicated the unwisdom of publishing patent data upon models of more modern character.

Specialists on the Colt revolver will be delighted to know that such rare specimens as "Confederate" and "Belgian" types have not been neglected. Even the lowly single-shot deringer is illustrated in all its types and variations. And furthermore its name is properly spelled—with no supernumerary "r" inserted.

Messrs. Haven and Belden are fortunate in having secured to prepare the foreword to their work no less a person than Stephen V. Grancsay, Curator of Arms and Armor of the Metropolitan Museum, New York, and to have had available as consultants and advisers the distinguished list of authorities whose names appear in the preface. They have made the most significant contribution to the literature on American small arms which has appeared in many a long year. Let it be hoped that it will not be their last.

C. G.

THE FLEET TODAY. By Kendall Banning. New York: Funk & Wagnalls Company. $2.50.

NOW that the Navy is more in the public eye than at any previous time in our history, the publication of this book is peculiarly appropriate. All Americans are naturally interested in tonnage of ships, thickness of armor, and caliber of guns and their number. But evidence has multiplied recently in the European war to confirm the old principle that morale is often of even greater significance than matériel in the outcome of war. Therefore, the men of our fleet are worth knowing well, and it would be difficult to find a better source for this information than Kendall Banning's latest book.

The author has adhered to the effective method of "West Point" and "Annapolis" by beginning with the selection of a

recruit for the Navy, his training, his assignment to the many different duties and types of surface ships, to the submarines, and to the naval Air Force, and ending with his discharge or retirement from active service.

In "Annapolis Today" the author gave us a vivid and engaging account of the transformation of midshipmen into ensigns during their four years at the Naval Academy, and it was but logical to follow this with a book describing the life of the men who serve under these officers. Once more it is the human side of the Navy that appeals to the author. This he describes with sympathetic and accurate knowledge gained by months of actual contact with all sides of the Navy afloat and ashore. The work, consequently, is a full-blooded story of the life of the fleet at sea and of the many establishments on land that support the seagoing Navy in personnel and matériel.

Colonel Banning may be a landlubber, but he has absorbed the salt of the sea and the lingo of the sailor to an extraordinary degree. His keen sense of humor enlivens a factual report of great value embellished with good sea yarns and with page after page of chuckles and satisfying "belly laughs."

It may not be out of place to suggest to the author that the time is ripe to use his even greater knowledge of the Army to expand his trilogy with a fourth volume of a similar nature dedicated to our land forces. D. A.

WHERE THEY HAVE TROD: THE WEST POINT TRADITION IN AMERICAN LIFE. By Lieut. Col. R. Ernest Dupuy, F.A. New York: Frederick A. Stokes Co. $3.00.

THE well-chosen subtitle to this volume admirably explains the true purpose of the author's work. He does not attempt a documented history of the Military Academy but rather a recording of the slow and toilsome building-up of the spirit and tradition of West Point and, what is an even greater task, an interpretation and appreciation of its far-reaching effect upon the life of our nation. In this, Colonel Dupuy's greatest success would seem to be that he has stressed the meaning of the Academy in science, engineering, and the many peace-time pursuits of the nation. For it is certain that few Americans realize the immense part that West Point, through its contacts and through its former students, graduate and nongraduate, always has played in our nation's upbuilding. And not to be lightly passed over is that part in the upholding of Americanism which the Military Academy is playing today.

The author's story goes back to the very beginnings of our nation—to the boyhood of Sylvanus Thayer who entered the Academy in 1807, five years after it was founded, but who nevertheless is known as "the father of the Military Academy." When Thayer matriculated, West Point was a gangling, unformed, haphazard affair. And when he returned as superintendent in 1818, it was, though considerably expanded, in a sad state. Just returned from an extended tour of duty in Europe, Thayer's model was the Polytechnique of France, and in the fifteen years of his sway, he hammered the Academy into an institution which, for well over a century, has weathered all storms and which still serves the nation as a center and disseminator of the best in American life.

Dennis Hart Mahan and Peter Michie are but two of a long line of superintendents who have carried on the spirit and character of the establishment. And Colonel Dupuy well shows that for the few young graduates who served in the war of 1812 as well as for the many upon whom now devolves the gigantic task of quickly and efficiently building up our new armies, West Point need have no apology.

The author's accounts of the wars and campaigns in which Military Academy graduates have played so great a part are necessarily very brief, yet they are enough to demonstrate the breadth and the soundness of their military foundations. Two well-separated incidents may be used to show the ample value of the military training at the Point: the War of 1812 (opening barely ten years after the founding of the school), in which the

PNEUMATIC ROCK DRILLING

was the ground school for Elastic Stop Nuts

Not until they were proved in the most gruelling industrial service, were Elastic Stop Nuts offered for aircraft. That was in 1927 when they had made good on rock drills where the vibration is the most severe known in any field.

• Now, these nuts are in their fourteenth year of successful use on aircraft . . . applied to major and secondary fastening jobs on every American military and transport plane, as well as on most foreign planes.

• Completing the cycle, industry has recognized their record in the air by adopting them for all classes of equipment, where, as on aircraft, they are promoting safety, speeding up production, and reducing maintenance costs.

A 56-page Catalog and Data Book contains a graphic explanation of the Elastic Stop principle, test and application data, and a complete listing of the nuts. • Write for a copy.

ELASTIC STOP NUT CORPORATION
2338A VAUXHALL ROAD • UNION, NEW JERSEY

THE NUTS WITH THE RESILIENT NON-METALLIC LOCKING COLLAR

Elastic Stop SELF-LOCKING NUTS

MAKE YOUR OLD MACHINES DO MORE

• You can do that now . . . without waiting. In the average plant, the general level of tool performance can be doubled . . . interruptions to production, caused by tools that wear or break too soon, cut in half. Total plant capacity can thus be substantially increased.

But can you get better tools without jamming tool-making facilities, without waiting for improved tool-making equipment?

The answer is, "You can not only get better tools, you can actually *relieve* pressure on the tool room . . . by improving and simplifying the selection and heat treatment of tool steels."

This Carpenter book on "Hidden Plant Capacity" tells how . . . gives procedure for getting more from each machine in your plant. Send for it today. No obligation. Only 14 minutes to read.

THE CARPENTER STEEL COMPANY
READING, PA.

Warehouses at: Chicago . Cleveland . St. Louis . Hartford
Indianapolis . Detroit . Philadelphia . Reading

• Uniformity in rifle boring determines, in large part, the number of accurate hits registered. For precisely the same reason, CLE-FORGE HIGH SPEED DRILLS are produced uniformly—so that they will PERFORM uniformly, and thus give the largest possible number of accurate holes per drill. Consequently, experience has shown that they possess a high rating when it comes to "cost-per-hole." Army men, accustomed to precision, will understand and appreciate this quality.

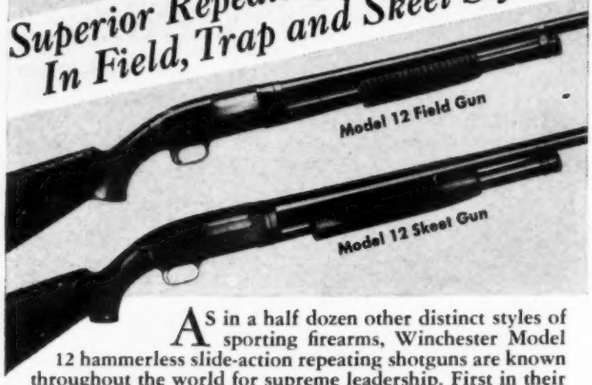
The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 654 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT · LONDON - E. P. BARNUM, LTD. - 25-36-37 UPPER THAMES ST.-E.C.4

CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Superior Repeating Shotguns
In Field, Trap and Skeet Styles



AS in a half dozen other distinct styles of sporting firearms, Winchester Model 12 hammerless slide-action repeating shotguns are known throughout the world for supreme leadership. First in their class to win wide and permanent success. First today in popularity. Designed and built for it, with characteristic Winchester firearms engineering leadership.

Furnished in 12, 16, 20 and 28 gauges, in a full range of styling, for game and skeet shooting. And in 12, 16 and 20 gauges in trap gun style. Winchester-Proof steel throughout – made to the formula of Winchester's own engineers, Winchester heat treated and of highest ballistic excellence. Famous Triple-Safety action. Unequalled in appearance, handling and all-around pump-gun performance.

Your dealer will show you the Winchester Model 12 and tell you its advantages. A copy of the latest Model 12 folder, illustrating and describing all styles, will be sent to you on request, without obligation. Please address Dept. 26.

WINCHESTER REPEATING ARMS COMPANY
Division of Western Cartridge Co.
NEW HAVEN CONN. U. S. A.

WINCHESTER
TRADE MARK

record of the graduates so shone as to save the Academy from stagnation and virtual strangulation by politicians, and the appraisement of the privates of the Army of Northern Virginia, whose comment was "West Pointers get there best but don't kill off their men when t'aint needful."

In these times, when American traditions of over a century are being merrily tossed away, "Where They Have Trod" is no less a delight than a duty for every American to read. Poison, of course, to the pacifist, the lopsided liberal, and the internationalist, this reviewer (a civilian, mind you) can and does recommend it to all "he men" as "a cup of cold water" amidst the parched desert of bureaucratic doctrinaires. F. W. F. G.

COMMODITIES IN INDUSTRY. New York: Prepared and published by Commodity Research Bureau, Inc. $7.50.

THIS book suffers greatly from an attempt to make it everything in one. Its format is that of a Christmas-gift book. Its editorial content is a mixture of irreconcilable factors. It attempts to give the business man serious data for the latest defense needs, to give the college freshman his first glimpse into production methods, and at the same time furnish an impressive magazine-type book for the "parlor" table.

Some seventy-five commodities are listed in the contents, but the descriptive matter has too much the appearance of the advertising bulletin matter of the companies listed in the "acknowledgements." The tables are taken largely from Government publications, especially from the annual reviews of the Bureau of Mines and the Statistical Abstracts of the Department of Commerce. Some of the chapters from official sources are serious; others are in a light vein. The work belongs to a type of composite advertising popular some years ago. G. S. B.

PISTOLS AT TEN PACES: THE STORY OF THE CODE OF HONOR IN AMERICA. By William Oliver Stevens. Boston: Houghton Mifflin Co. $3.00.

THE above subtitle would indicate that Mr. Stevens originally had intended his work to be a history of dueling in America. It is a pity that he did not keep this objective in mind, for the description of several of the more famous American duels is of real interest. Especially is this true of the encounter which ended in the death of Commodore Decatur. The chapter devoted to this affair is well above the general level of the book, both in style and in interest. The bulk of the volume, however, is filled with a potpourri of innumerable and unrelated brawls and duels of no particular significance or interest today. And in the treatment of these, as well as of the subject of dueling in general, the author indulges in such a flow of sarcastic derogation that he seems to be "beating a dead horse." And the historical background of the duel is approached with a rather crude humor which is the reverse of serious or judicial consideration. F. W. F. G.

BOOKS RECEIVED

FROM PANAMA TO VERDUN. By Col. Philippe Bunau-Varilla. Philadelphia: Dorrance & Company. $2.50.

STRENGTH OF MATERIALS. By S. Timoshenko. New York: D. Van Nostrand Company, Inc. $3.50.

BATTLE SHIELD OF THE REPUBLIC. By Maj. Malcolm Wheeler-Nicholson. New York: The Macmillan Company. $1.50.

MATERIALS HANDBOOK (Fourth Edition). By George S. Brady. New York: McGraw-Hill Book Company, Inc. $5.00.

BLITZKRIEG. By S. L. A. Marshall. New York: William Morrow & Company. $2.00.

THE ARMY OFFICER'S ANNUAL POCKET REFERENCE BOOK AND 1940-41 CALENDAR. By Capt. Peter Rodyenko. Manhasset, L. I., N. Y. $1.00.

THE ARMY WAY. By Philip Wylie and William W. Muir New York: Farrar & Rinehart, Inc.

THE ABC's OF THE I.D.R. (The New Close Order Drill). By Paul Brown. New York: The Macmillan Company. $.50.